# Singapore's COVID-19 Response and Rethinking the New Urban Normal

## A Commentary

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A public housing town in Singapore.
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# Acknowledgements

# Preamble

## Cities are at the forefront of the COVID-19 pandemic.

Cities are important nodes of development, both a result and a driver of economic transformation worldwide. However, with large populations interacting daily in offices, schools, healthcare spaces, transit, dining, recreation and residential areas, and high levels of global connectivity, it is unsurprising that recent data showed that an estimated 90 percent of reported COVID-19 cases globally have been from urban areas.[1]

## Singapore, a highly dense city-state, has not been spared the COVID-19 challenge.

Like in many cities, the crisis has been of an unexpected speed and scale in Singapore. While Singapore has had previous experiences in dealing with the severe acute respiratory syndrome (SARS) epidemic in 2003, COVID-19 has posed a greater risk in terms of community spread. The global nature of COVID-19 also means that Singapore's position as a major international travel and business hub has been impacted and it has had to respond to supply chain disruptions due to border restrictions, and a slowdown in air and sea freight. Meanwhile, the prolonged COVID-19 disruption has also elevated considerations for how we plan and build our city in the medium and long term, with health and wellness as key considerations.

## A commentary on 2020/2021

This commentary reflects on some of Singapore's responses to the COVID-19 pandemic, primarily from the built environment and infrastructure perspective. In doing so, it considers how the public sector, private sector and communities, have had to adapt and work together in responding to the COVID-19 disruption.

This commentary weaves together the experiences, insights and ideas of key leaders involved in responding to the crisis from early 2020 to mid-2021, discussing what worked well, or less so, and the challenges and trade-offs that had to be addressed along the way. It also posits several ideas and (re)thinking from urban system practitioners on how we may need to evolve the way we plan, develop and operate our city.

We recognise that the fight against the pandemic is not yet over in Singapore, nor that our experience necessarily holds all the answers. We hope simply for this piece to spark new conversations among urban leaders and policymakers across the world, so that our cities will continue to be liveable, sustainable and resilient to future shocks and stressors.

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[1] United Nations, "Policy Brief: COVID-19 in an Urban World", July 2020.

Overview
# Singapore, the resilience imperative

As an island constrained by limited land and natural resources, Singapore has always been keenly aware of the need for resilience.

Singapore has had to balance competing land requirements to meet the different economic, social and environmental needs of a city-state, all within its 728 km² of land.[2] While striving to keep an open and well-connected economy, the risks of supply chain disruptions need to be mitigated by diversifying import sources or in-shoring essential activities and production.

And, while Singapore is relatively sheltered from natural disasters, it has experienced its fair share of shocks and crises over the years: physical challenges such as flooding, financial crises, terrorism-related incidents and public health crises.

## Singapore's crisis management capability

Singapore has built up its ability to respond to crises over time, through continual learning from past crises and the experience of other cities. The Homefront Crisis Executive Group (HCEG) coordinates the responses of public agencies during crises, overseeing Crisis Management Groups (CMGs) that muster relevant agencies to deal with different types of incidents, including health-related ones.

## The SARS experience and responses to shore up public health resilience

Having governance structures and legislation in place to deal with health-related incidents is important. Singapore, as an open economy, has always been at risk from globally transmitted diseases.

In 2003, the severe acute respiratory syndrome (SARS) epidemic hit Singapore, infecting 238 persons and claiming 33 lives. While the outbreak was successfully contained within two and a half months, the episode prompted the expansion of Singapore's capacity for dealing with epidemics and pandemics across its healthcare workforce and infrastructure, as well as the institution of new emergency preparedness and coordination structures.

— For instance, the National Centre for Infectious Diseases was established as a key infrastructure for isolation and surge capacity. Government Quarantine Facilities were set up, and preparation measures included maintaining chalets, holding drill exercises and occasionally activating them for use when needed. Contact tracing practices were developed, and operational preparedness was tested with regular simulation exercises.

— A Disease Outbreak Response System Condition (DORSCON) framework was developed to prepare the city's healthcare infrastructure and public sector agencies for disease-related contingencies. Whenever there is an outbreak situation requiring DORSCON to be elevated to Yellow, the CMG for Health is activated to lead the Whole-of-Government management of disease outbreaks.

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[2] As of end December 2020 (Source: Department of Statistics, Singapore).

— During SARS, the community was also mobilised to work together to contain the virus. This included monitoring and screening, keeping hygiene standards high in public places and ground-level initiatives such as neighbours sending food and groceries to those under quarantine.

## COVID-19: Beyond a local public health crisis

The crisis management capabilities and coordination structures in place before SARS, and enhanced after, have allowed comprehensive measures to be rolled out to protect Singapore in the face of COVID-19. This includes contact tracing, activating Government Quarantine Facilities, issuance of travel advisories and instituting temperature checks at entry points into Singapore, amongst others.

On 22 January 2020, Singapore set up the Multi-Ministry Task Force (MTF) to manage the COVID-19 pandemic response, supported by the HCEG. The DORSCON framework has been used to guide the level of responses and measures, with the MTF and HCEG coordinating the management of COVID-19 by public agencies.

Yet, while the SARS outbreak in Singapore was primarily linked to health facilities, the COVID-19 crisis has brought with it a major risk of community spread and has been unprecedented in its scale and speed. This demanded the rapid creation of additional facilities for isolation and medical care, led by the public sector, with strong support from the private sector (Chapter 1).

Keeping communities safe also required effective coordination between public, private and people sectors, self-mobilisation by communities and non-governmental organisations (Chapter 3), and the roll-out of new digital services to facilitate safe distancing and quarantine monitoring (Chapter 6).

But, COVID-19 has been more than a local public health crisis. The global nature of COVID-19 also means that Singapore has had to respond to supply chain disruptions. Emergency procurement of essential goods and materials necessitated new storage facilities, some with unique requirements (Chapter 2).

The prospect of a prolonged COVID-19 disruption has also prompted considerations of how we can ensure the hygiene of public spaces, develop buildings that safeguard public health and safety (Chapter 4); and in the long-term, plan buildings and neighbourhoods to promote health and wellness (Chapters 4 and 5).

**Chapter 1**

# Emergency preparedness
## *Just-in-time or just-in-case?*

To be prepared for emergencies, "just-in-case" measures are required—cities must plan and build in capacity for contingency uses such as emergency housing, civil defence shelters and quarantine facilities. Since the severe acute respiratory syndrome (SARS) epidemic, Singapore has increased its quarantine capacity and put in place quarantine protocols, including preparing government chalets as backup emergency housing, holding drill exercises and occasionally activating them. Alongside this, authorities also developed comprehensive contact tracing and quarantine procedures required to contain the outbreaks of infectious diseases.

However, it is unrealistic to expect a city to be fully prepared for all eventualities. Building in spare capacity entails holding and maintenance costs, and possibly some wastage,[3] as spare capacity remains idle and eventually becomes outdated or must be refreshed. This means that cities must also be able to respond "just-in-time", to adapt to major disruptions from crises of different scales, unpredictability and complexity.

With COVID-19, Singapore has had to deal with a significantly higher risk of community spread. While the machinery for Government Quarantine Facilities worked well as part of Singapore's COVID-19 response, its provision had to be rapidly scaled up.[4] Singapore has also had to convert spaces previously used for other purposes, or which were temporarily unused, into healthcare and quarantine facilities, and to activate hotels across the island to serve as isolation facilities.

## Observation 1:
## Coordination between agencies and up-to-date information on "spare" physical capacity is key to effective just-in-time responses.



**Fig 1.** Since SARS, Singapore has increased its quarantine capacity, including preparing chalets as backup emergency housing, holding drill exercises and occasionally activating them. These were quickly activated when COVID-19 struck. *Image courtesy of Civil Service College.*

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[3] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.

[4] Centre for Liveable Cities' research consultation with Ow Foong Pheng.

Before COVID-19, Singapore already had in place multiple configurations for Crisis Management Groups to deal with different scenarios, with the Homefront Crisis Executive Group as a central coordinating committee.[5]

When COVID-19 first reached Singapore in early 2020, the country activated various types of spaces to serve as healthcare and quarantine facilities. Healthcare facilities were coordinated by the Ministry of Health with support from the Ministry of National Development (MND). Quarantine and emergency accommodation facilities were coordinated by a workgroup headed by the MND, comprising officers from many other Ministries and public agencies. The workgroup sought to collate a central view of spaces with the potential to be converted. Beyond these formal coordination structures, established networks among public agencies also made it easier to communicate urgent requirements and collect information.

*The ability to pick up the phone and ask another agency for help, for example, in sourcing vacant land for quick build dormitories, in fact demonstrates that resilience is in-built in the networks.*[6]

**Hwang Yu-Ning** Chief Planner and Deputy CEO, Urban Redevelopment Authority

Being prepared for future disruptions requires that cities regularly review land and infrastructure needs across the crisis response structure, in preparation for different scenarios.[7] Cities can consider adopting a multi-sectoral approach to planning emergency operational resources such as temporary accommodation, stockpiling, logistics and storage. In Singapore, some emergency planning was already managed in a multi-sectoral manner prior to the pandemic. But, COVID-19 has demonstrated that increased multi-sectoral scenario and emergency planning may be important to ensure a coordinated, concerted response, in the event of another perfect storm in future.[8]

# Observation 2:
## Cities must stay agile to adapt and respond to new information and exigencies.

*Every crisis is different. While learnings from past crises, e.g. SARS, can provide the foundation for response measures, you need to have the ability to quickly innovate to respond to new needs.*[9]

**Ow Foong Pheng** Permanent Secretary, Ministry of National Development

*When the problem you need to solve is tomorrow, the infrastructure that is not in place now will not be in time.*[10]

**Julian Goh** Senior Director, Ministry of National Development

Amidst the challenges of COVID-19, decisions on planning and operationalising just-in-time facilities had to be made without full facts either because there were no precedents, or because there was just not enough time to gather data before a response was required. This meant that agencies had to remain alert and agile to the evolving situation.

For example, while the Stay-Home Notice (SHN)[11] was initially allowed to be served at home, as more was known about the easy transmissibility of COVID-19 between household members, protocols had to be changed to require it to be served in dedicated facilities.

When infections in migrant worker dormitories emerged, authorities soon realised that providing end-to-end isolation and community care for migrant workers required a range of housing types for different sub-groups of such workers. For example, facilities were needed to house healthy essential workers, COVID-positive but otherwise asymptomatic workers, recovering workers needing only step-down care, and workers who had completed quarantine but who could not return to their dorms because of ongoing outbreaks. Resource needs and workflows had to be customised for each facility type.[12]

As the situation evolved, agencies went beyond their usual scope of work. The Housing & Development Board provided temporary accommodation by converting older flats and building temporary accommodation. Agencies such as the Singapore Land Authority, JTC Corporation, Ministry of Education, Ministry of Defence, Tote Board, People's Association and Sport Singapore, which are not usually involved in housing matters,

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[5] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.

[6] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.

[7] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.

[8] Hugh Lim, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 30 April 2021.

[9] Centre for Liveable Cities' research consultation with Ow Foong Pheng.

[10] Julian Goh, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 28 April 2021.

[11] A legal notice issued under Singapore's Infectious Diseases Act that requires one to remain in their place of residence or a SHN-Dedicated Facility (SDF) for a stipulated period.

[12] Ibid.

also stepped up to retrofit and manage properties under their charge that could be used as emergency accommodation.

With multiple agencies involved, it was also important to ensure knowledge transfer of operational considerations and workflows in the various facility types, especially as the response teams had to learn whilst they worked to tackle a novel crisis of unprecedented scale.[13] For instance, addressing the needs of migrant workers involved an intricate and inter-dependent process across a set of agencies, from testing the workers, to transporting them to the appropriate quarantine and care facilities, supporting their needs during their stay, and then bringing back to their dormitories.[14]

## Observation 3:
### Effective crisis response requires harnessing whole-of-society support.

The scale of the COVID-19 outbreak required resources across society to be harnessed to respond to the public health challenge. For example, the earliest COVID-19 cases were hospitalised at the National Centre for Infectious Diseases (established after SARS). As the scale of COVID-19 grew, other public hospitals were brought into the fight. For the first time, the government also partnered with private hospitals for its public health response.

Quarantine and community care facilities also required a whole-of-society response. By June 2020, 36 state properties, which included former schools and vacant factories, would be used as alternative housing for about 25,000 migrant workers, adding to the existing stock of Government Quarantine Facilities.[15] Unused public buildings such as public housing flats (vacated for redevelopment) and the Sports Hub were also deployed for such uses.

Private sector providers were also harnessed in the response to COVID-19. For instance, when Malaysia began its first Movement Control
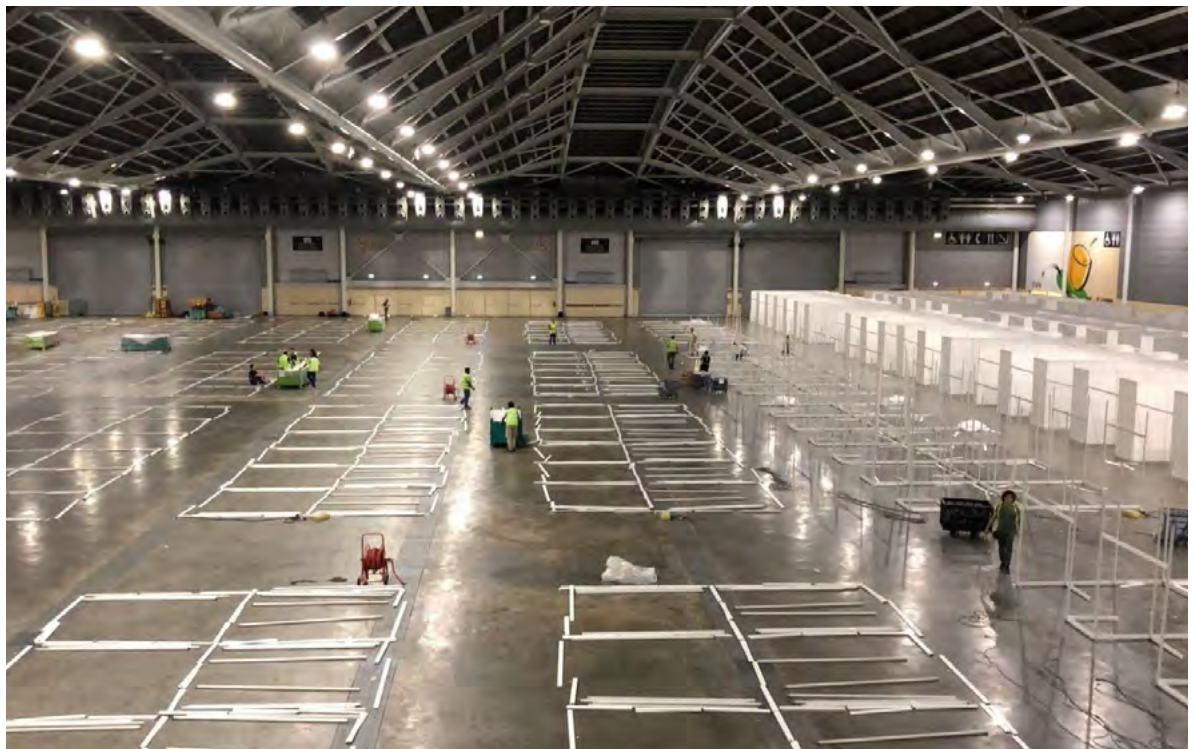


**Fig 2.** In April 2020, many private organisations worked together to re-configure 10 exhibition halls at the Singapore Expo into an 8,000-bed community care facility for COVID-19 patients who were asymptomatic or had mild symptoms. *Image courtesy of Surbana Jurong.*

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[13] Julian Goh, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 28 April 2021.
[14] Jason Chen, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 21 May 2021.
[15] Ang Hwee Min, "Former school buildings among 36 state properties to be converted to temporary housing for migrant workers" in *Channel News Asia*, 2 June 2020. https://www.channelnewsasia.com/news/singapore/covid-19-migrant-workers-housing-former-schools-state-properties-12792710
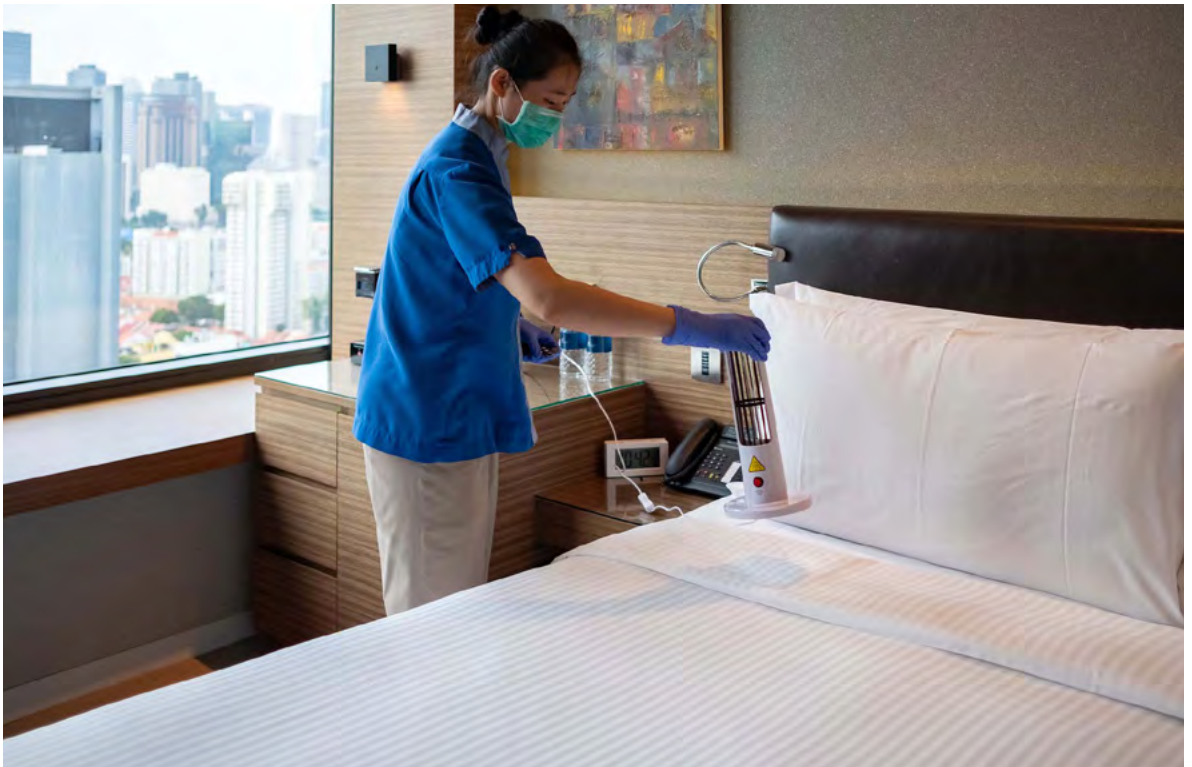
**Fig 3.** In sourcing for hotels to serve as dedicated facilities for those serving the Stay-Home Notice, coordinating agencies had to be agile in structuring contracts given the variety of needs and requirements. *Image courtesy of One Farrer Hotel.*

Order at short notice on 18 March 2020, Singapore had to move fast to house Malaysian workers stranded by the border closure—no mean feat given that pre-COVID, more than 300,000 Malaysians crossed the border into Singapore daily for work.[16] In response, the MND approached the Singapore Tourism Board (STB) to help source suitable hotel accommodation for the workers. The STB was also approached to size up and oversee a significant number of hotels to serve as dedicated facilities for those serving the Stay-Home Notice. Working with private sector providers such as hotels required expertise and agility in structuring contracts, and the Singapore Land Authority was brought in to lend their procurement and contractual expertise to work out appropriate contractual terms with different hotels.

Private sector entities also came forward to offer available spaces for quarantine or other temporary facilities.[17] For example, in early March 2020, Far East Organization, a developer, offered to hand over one of its leasehold properties, Chancery Court, for the government's use as temporary accommodation for affected migrant workers. To date, the property continues to be in use for this purpose.[18] In mid-April 2020, PSA International, a global port group headquartered in Singapore, activated and repurposed its Tanjong Pagar Terminal for community care and quarantine facilities, building tentages and berthing "floatels" (floating hotels). By late July 2020, it was fully repurposed with a 7,000-bed capacity.[19]

The private sector also worked together to apply their competencies to address the challenges of the time. In April 2020, PSA International coordinated the efforts of many private organisations to re-configure 10 exhibition halls at the Singapore Expo into an 8,000-bed community care facility for COVID-19 patients who were asymptomatic or had mild symptoms. By the end of 2020, the facility had cared for more than 14,000 patients.

Surbana Jurong was one of the partners tasked to re-configure several exhibition halls at the Singapore Expo as a community care facility within 36 hours.[20] Its designers, engineers and

[16] Ong, J. and Yusof, A., "Clearing the Causeway" in *Channel News Asia*, 5 Feb 2021. https://infographics.channelnewsasia.com/interactive/causewayjam/index.html#article
[17] Julian Goh, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 28 April 2021.
[18] Marc Boey, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 4 June 2021.
[19] Ibid.
[20] Wong Heang Fine, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 25 May 2021.

facilities management teams worked together to solve challenging health and safety issues, including improving air circulation, sanitation and water supply systems. The procurement team tapped on various supply networks to source goods and services for this project, even as global supply chains had been disrupted.

*Re-configuring an existing building to fit a community care facility required a radical departure from traditional ways of thinking.*[21]

**Wong Heang Fine** Group CEO, Surbana Jurong

The private sector has the agility, resources, capabilities, and competencies for a city to tap on in times of need and will continue to remain a key actor in supporting the resilience of cities.

*Extraordinary times made for extraordinary collaboration. Public agencies and the private sector alike adopted a pragmatic stance and we were able to move things at speed. Everyone was willing to roll up their sleeves and just get things done, in order to provide the nation with the means to contain, segregate and care for the infected.*[22]

**Tan Chong Meng** Group CEO, PSA International

## Observation 4:
## Multi-use facilities can help close gaps between "just-in-time" and "just-in-case" measures.

To prepare a city to respond to crises of different scales, both just-in-case and just-in-time approaches are required. Instead of trying to decide on the primacy of either approach, a city may need to ask what the right balance of multifunctionality is for the urban assets it

possesses and whether measures proposed are cost-effective.[23]

*The premium to being ready has to be paid upfront.*[24]

**Hugh Lim** Executive Director, Centre for Liveable Cities

For example, SARS in 2003 prompted a relook of dual and multi-use spaces within public healthcare institutions. At KK Women's and Children's Hospital, for instance, selected wards had been converted into outpatient consultation rooms that could be retrofitted in 24 hours to become isolation rooms. These dual-use facilities allow for more efficient use of space and minimise holding costs of maintaining pure surge capacity.

The involvement of hotels in Singapore's COVID-19 response demonstrates a potential new "dual-use".[25] Conversations are afoot in exploring the business viability of including more hotels in emergency preparedness plans, as assets that can be mobilised for crisis response in the future. New infrastructure projects should also be planned with due considerations for potential dual or multi-use.

Beyond land and infrastructure, operating models and resources to support dual-use and multi-use facilities also need to be considered, to enable their swift conversion to alternative uses in times of crisis.[26] For instance, standard operating procedures for the emergency usage of Government Quarantine Facilities were already in place prior to COVID-19, with regular simulation exercises conducted. Other capacities also need to be planned for such as sizing up utility provision appropriately, provisioning swing capacity for hardware such as portable generators, portable toilets, Wi-Fi, and human capacity in services, such as security, catering, logistics, engineering, and building and facility management.

[21] Ibid.
[22] Tan Chong Meng, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 June 2021.
[23] Centre for Liveable Cities' research consultation with Dr Cheong Koon Hean.
[24] Hugh Lim, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 30 April 2021.
[25] Ibid.
[26] Ibid.

**Chapter 2**

# Supply chain disruptions
## *How do we ensure the essentials?*

The global nature of the COVID-19 pandemic has meant that cities around the world have had to respond to supply chain disruptions. This is a particular challenge for Singapore. As a city-state of more than 5.5 million people with 728 km$^2$ of land, Singapore has limited land to produce much of its goods and food, and leverages its connectivity and global trade to facilitate supply flows.

Learning from its experience with the severe acute respiratory syndrome (SARS) epidemic in 2003, Singapore has kept stockpiles of certain essentials such as food and medical supplies. These stockpiles are determined by a range of factors such as consumption rate, supply chain reliability, resupply rates and frequencies, shelf life, cost of storage, possible duration of disruptions and local production surge capacities.[27] As a result, Singapore appeared sufficiently prepared as COVID-19 hit.

However, the speed and scale of border closures, trade restrictions and business activity curtailment as a result of lockdowns during the COVID-19 pandemic were unprecedented. As the situation escalated across the world, multiple supply lines were disrupted at the same time due to widespread border closures, lockdowns, flight cancellations and shipping delays, impacting the production and flow of goods into Singapore. Panic buying further

exacerbated the situation, resulting in temporary retail shortages of some food items, and even non-essentials such as toilet paper.

## Observation 1:
### Flexibility of land and space usage is key to catering for surge stockpiling capacity and requires agility in roll-out.

As with all cities and regions, Singapore faced difficulties in securing essentials amidst the disruptions. Stockpiling was a necessary first response. Both the government and the private sector began to stock up on its stores of essential goods. Storage spaces became scarce and new ones had to be set up quickly.

That said, not all storage spaces are equal. Several types of storage facilities were required to accommodate the unique nature of specific goods: for example, reefer storage of different temperatures for perishable foods, sterilised cold storage rooms for medicines, fire-safe warehouses for flammable products such as alcohol required for hand sanitisers, large dry warehousing for construction materials, and others.

**Changes in Container Throughput and Sea Cargo Handled**
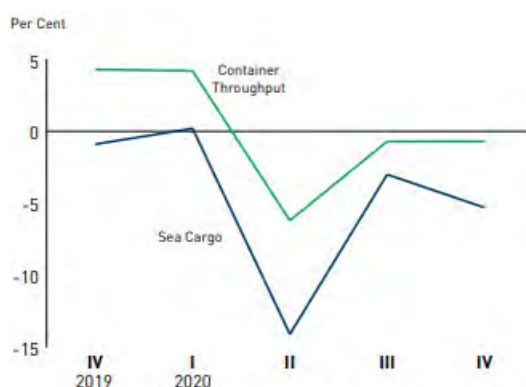


**Changes in Air Transport**
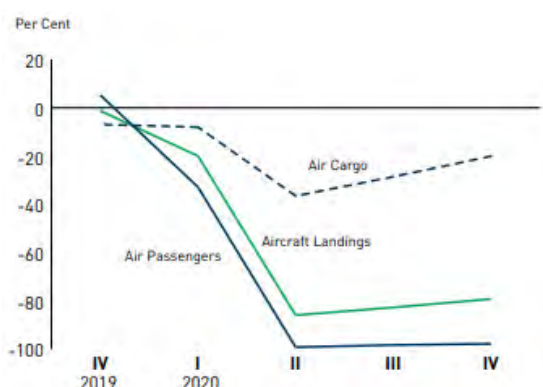


**Exhibit 1.** There was a sharp drop of both container throughput and air cargo in the early months of COVID-19, disrupting supply chains. *Image courtesy of the Ministry of Trade and Industry.*

[27] Parliament of Singapore, "Impact of COVID-19 Restrictions on Singapore's Economy and Robustness of National Stockpile of Essential Items", Singapore Parliamentary Records Vol. 94, 6 April 2020. https://sprs.parl.gov.sg/search/sprs3topic?reportid=oral-answer-2191

**Fig 4.** The recently decommissioned Tanjong Pagar Terminal was converted into a temporary large storage and warehousing facility to stockpile essentials. *Image courtesy of Hit1912, Shutterstock.*

Flexibility in use was key to realising some of these new storage spaces, and many spaces were identified and quickly retrofitted for storage. One of the largest retrofits was at the recently decommissioned Tanjong Pagar Terminal, where parts of the 80 ha port were retrofitted and repurposed into a dedicated cold storage facility between April and August 2020, storing a total of 100,000 tonnes of frozen vegetables and proteins.

*Land zoning is important in the way we plan a city during peacetime. But in a crisis, what is needed is the ingenuity and courage of the prevailing team of people working on the crisis to adapt, respond decisively and creatively to re-purpose the spaces for the most critical needs of the day.*[28]

**Lim Kok Thai** CEO, Singapore Food Agency

Setting up new storage spaces, however, was not just a matter of stacking containers or creating warehouses. It involved seeking approvals from various parties and authorities. For example, planning approval is required from the Urban Redevelopment Authority, while technical agencies such as the Singapore Civil Defence Force and Land Transport Authority would evaluate the fire safety and traffic impact of proposals. Furthermore, qualified persons are required to be engaged to submit and certify proposals. Amidst the pandemic, it became necessary for regulators to streamline the process and train others to ensure that certification could be done quickly without compromising safety or quality.

Stock management systems also had to be put in place to manage stock changes, turnover and shelf lives. At the beginning of the pandemic, each agency sourced what it needed quickly, in recognition of the urgency. A more centralised approach could potentially improve efficiencies, for example, by discovering more sources and not competing for the same limited sources of supply, while retaining a level of flexibility to ensure that agencies could procure what was needed.

## Observation 2:
### To prepare for crises of unexpected scale, cities may need to expand their scope in stockpiling and have an emergency procurement strategy.

Stockpiling will continue to be an important part of Singapore's supply chain resilience strategy. However, the scale of COVID-19's impact suggests that planning parameters and contingency timeframes may need to be revisited, and even the range of items to be stockpiled to be expanded.

"Red teaming" is one strategy that may prove useful in assessing the needs for stockpiling in different emergency scenarios. While a "blue team" creates a plan, a "red team" reviews

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[28] Centre for Liveable Cities' research consultation with Lim Kok Thai.

the plan, challenging assumptions and thereby ensuring a more robust plan.

*We need to provide for the most probable scenarios, while planning for the most dangerous scenarios—and maintain the ability to respond should it go to the most dangerous scenarios. And contingency plans must never remain static.*[29]

**Hugh Lim** Executive Director, Centre for Liveable Cities



**Fig 5.** An aerial view of the Citiponics urban farm, located on the rooftop of a multistorey carpark in a housing town. *Image courtesy of Citiponics Pte Ltd.*

Expanding the scope of stockpiling will have implications on space and infrastructure needs —cities will need to consider how to enlarge the capacity of current storage spaces, and build well-connected transport links to ensure effective and agile last-mile distribution of items within the city.

Cities also need to consider emergency procurement strategies. For instance, the Singapore Food Agency (SFA) had structured emergency procurement clauses at the onset of its formation. This allowed it to quickly activate emergency procurement contracts amid the supply chain disruptions in 2020, to work with essential firms to secure overseas food supplies. The emergency procurement clauses even enabled SFA to support other agencies in their COVID-19 response efforts, for example, in quickly engaging manpower for enforcing safe management measures.[30]

## Observation 3:
## Cities need to make innovative uses of land and space to ramp up local production.

To achieve resilience, cities need to build capabilities and capacities for local production to achieve some degree of self-sufficiency for essential items. Ramping up local production will come with its attendant challenges, such as the need for more land and workers, and



**Fig 6.** Straits Construction Group's Greyform Building, an example of an Integrated Construction and Prefabrication Hub, a multistorey manufacturing facility with a high degree of mechanisation and automation that allows for more efficient land and space utilisation.. *Image courtesy of Straits Construction Group.*

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[29] Hugh Lim, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 30 April 2021.
[30] Centre for Liveable Cities' research consultation with Lim Kok Thai.

high-density cities like Singapore will need to innovate within their land and resource constraints, and continually review these needs.

Before COVID-19, Singapore already sought to increase local food production through its "30 by 30" goal.[31] The COVID-19 pandemic accentuated Singapore's vulnerability to external volatility in the global food market, and was a reminder of the importance of shoring up local production to buffer against overseas supply disruption. The government responded by ramping up local production, with the launch of the "30 x 30 Express" Grant. A grant call was launched, and close to $40 million in funding was awarded to nine companies, to give them a boost in scaling up production of key food items like leafy vegetables, eggs and fish. Alternative spaces like Housing & Development Board multi-storey carpark rooftops were also activated quickly and tendered out for commercial farming.

Another essential resource for Singapore is construction materials. Singapore stockpiles construction aggregates that can be tapped on during supply disruptions. The country also encourages the development of Integrated Construction and Prefabrication Hubs— multi-storey manufacturing facilities with a high degree of mechanisation and automation, for more efficient land and space utilisation, as well as reduction of wastage of raw materials.

## Observation 4:
## Cities need to better address risks and interdependencies in essential supply chains.

While some essential items can be produced locally, the majority of Singapore's and other cities' goods may still need to be sourced from elsewhere. To build resilient supply, cities need to have a good understanding of each supply chain, and the risks and interdependencies within.

Diversification is a key strategy to mitigate risks of supply disruption from any single source country. Since the global food crisis in 2007, Singapore has expanded its sources of food and now imports food from more than 170 countries and regions around the world. This is made possible through efforts by SFA to conduct regular business matching trips, explore new import sources, and strengthen existing trade ties in collaboration with other agencies. Since 2019, a new licensing requirement has also been implemented for egg importers to submit business continuity plans with preventive measures to mitigate the impact of supply disruptions. With heightened awareness of food security amidst COVID-19, SFA also took the opportunity to pursue new import sources, successfully bringing in eggs from Thailand, Ukraine and Poland.



**Exhibit 2.** As it relies on imports for 90% of its foods, Singapore takes food source diversification seriously, including taking punitive action on firms that did not have the requisite business continuity plans. In contrast, in response to COVID-19, some firms switched to the production of essential goods to help address shortages. *Adapted from: Wong Pei Ting, Today, 28 July 2020 and Tang See Kit, CNA, 14 September 2020.*

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[31] Chang Ai-Lien, "Singapore sets 30% goal for home-grown food by 2030". in *Straits Times*, 8 March 2019. https://www.straitstimes.com/singapore/spore-sets-30-goal-for-home-grown-food-by-2030

**Fig 7.** A public officer from the Singapore Food Agency checking eggs imported from Ukraine. *Image courtesy of Singapore Food Agency.*

Interdependencies between supply chains also need to be assessed. For food supply chains, it is important to look upstream and pay attention to securing an adequate supply of agri-inputs within the country, such as for seeds, vaccines and feed ingredients. Due to disruptions during COVID-19, local egg farms faced challenges to bring in raw materials like limestone for chicken feed from their regular sources.

Establishing partnerships and contracts with overseas suppliers to secure essentials has helped, but has not always been 100% reliable. For example, at the start of the pandemic, a government-linked company based overseas was blocked from exporting its surgical masks to Singapore, due to export bans. To address this, the company had to relocate some of its production lines back to Singapore, which took precious additional time.

Since then, Singapore has worked closely with other nations to keep borders open even in times of crisis. By March 2020, Singapore, Australia, Brunei Darussalam, Canada, Chile, Lao PDR, Myanmar, New Zealand and Uruguay had come together to affirm commitments to maintaining open and connected supply chains. Over time, Singapore has continued to ensure the flow of good and supplies, despite subsequent border closures and transshipment changes. Singapore has also shored up its international contracts to keep trade flowing.

Risks in the supply chain can also be addressed by leveraging the private and non-profit sectors. In the early days of the pandemic, the private sector was able to act quickly to fill gaps in supplies. For example, a Singapore-based digital printing company purchased mask production machinery from China and trained its entire staff to switch to mask production.

Between June 2020 and March 2021, Temasek Foundation, a non-profit organisation under the philanthropic arm of Singapore state sovereign fund Temasek, also sourced and distributed more than 30 million reusable face masks to the Singapore community via four nationwide distributions. All residents were able to collect one set of free reusable mask from each distribution, through vending machines located islandwide.[32]

## Observation 5:
## Cities must seek to move towards greater circularity in the medium-term.

Ultimately, supply chain disruptions highlighted the need to promote a more sustainable way of living. Rather than the linear, throw-away culture that is prevalent in society today, a circular system would mean that Singapore is able to make its

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[32] Ng Boon Heong, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 4 June 2021.

resources last longer. Reusing discarded items, or refurbishing, is an effective way of reducing dependency on imports.

For example, when students were required to move to home-based learning during the COVID-19 disruption, many were in need of individual computing devices. With the slowdown in supply chains, many could not get computers in time. While the Ministry of Education had loaned thousands of stockpiled devices, it was insufficient for the considerable need. Fortunately, multiple companies were able to quickly refurbish computers to be made available. Community organisations, such as Engineering Good, also partnered with social services to refurbish old donated laptops and computers to be delivered to students in need.[33]

Further upstream, Singapore has long been investing in research and development to identify innovative ways to improve recycling and reuse rates. It is currently looking at repurposing its incinerator bottom ash as NEWSand to be used as road construction material. These, and other creative solutions, will be crucial to ensure Singapore is less dependent on imports and the global supply chain.

*Cities will need to plan with resilience and sustainability even more at the forefront… this includes designing for circularity wherever possible.*[34]

**Tan Chong Meng** Group CEO, PSA International

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[33] Chandra, Alif. "Heroes Unmasked: They fix donated laptops to give to students from low-income families for home-based learning". In *Today*, 10 April 2020. https://www.todayonline.com/singapore/heroes-unmasked-engineers-fix-donated-laptops-give-students-low-income-families-home-based

[34] Tan Chong Meng, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 June 2021.

**Chapter 3**

# Whole-of-society resilience
## *Instinct or collective action?*

Chapters 1 and 2 outlined Singapore's responses in readying physical infrastructure to respond to the crisis such as setting up quarantine facilities and temporary storage spaces. These efforts are being led by the public sector, but the initiative and support of the private sector have been critical in ensuring these spaces are made available in time.

As community spread is a major risk for COVID-19, a wider response is needed. Information about the coronavirus has to be disseminated in a timely fashion to residents, with additional support rendered for seniors, vulnerable groups and those whose livelihoods may be disrupted. Various industries and business groups need to be mobilised to support the crisis response or given timely guidance on new safe operating regulations. Given that some communities and non-governmental organisations (NGOs) also demonstrate the instincts and ability to self-mobilise, how might these be supported and enhanced?

## Observation 1:
### Virtual and physical "nodes" in the community help in the effective dissemination of information and support.

From the early days of COVID-19 in Singapore, the Multi-Ministry Task Force has been transparent in reporting the daily number of COVID-19 cases and rolls out important crisis response information in a timely fashion. The Government Technology Agency is supporting this effort by creating virtual information platforms. These include a dedicated infobot and webpage summarising COVID-19 information on government websites. Residents can also sign up for bite-sized information through messaging platforms such as WhatsApp and Telegram. These virtual platforms are important in ensuring the speedy dissemination of important and trusted information.

Physical "nodes" in the community, in particular Community Clubs (CCs), also play an important role in rendering information and support.

Singapore has a network of more than 100 CCs that offer common spaces and facilities for residents to use. Each CC serves about 15,000 households, or an average of 50,000 people. In February 2020, CCs were activated as collection centres for the first city-wide mask distribution exercise, with senior citizens and vulnerable segments of society given priority. In March 2020, the CCs were again activated for the public distribution of hand sanitiser donated by Temasek Foundation. To support those whose livelihoods might have been affected by COVID-19, selected CCs have also been activated as satellite jobs and skills centres to provide information on jobs, traineeships and training opportunities.

## Observation 2:
### Beyond a regulator role, the public sector must build "softer" structures with industries and business groups.

Public agencies have had to engage different industry groups throughout the COVID-19 crisis to support a whole-of-society response. Amidst panic buying in supermarkets in February 2020, public agencies worked with businesses to quickly restock supermarkets and arranged protected times in supermarkets for elderly citizens to shop. Public agencies also guided employers, businesses and community organisations to implement safeguards such as safe distancing of employees, diners and worshippers, as well as mandatory temperature checks and check-in procedures. In addition, the Urban Redevelopment Authority engaged stakeholders such as operators of malls and supermarkets to provide crowd level data of their premises on the Space Out website, to help people make more informed decisions when heading out to make essential purchases.

The urgency of the COVID-19 situation required timely and clear dissemination of information. At the same time, agencies needed to hear the feedback and questions from the industries and businesses. Clear points of contact, both on the agencies' and businesses' end, as well as

**Fig 8.** NTUC Fairprice, a social enterprise, delivered essential groceries to residents during Singapore's circuit breaker to ensure that the elderly and the mobility-disadvantaged could still access food. *Image courtesy of Singapore Press Holdings.*

previously built up "soft structures" for industry engagement, have proved useful.

For example, COVID-19 was particularly challenging for the built environment sector. All construction activities came to an unprecedented stop during the "circuit breaker" period when elevated safe distancing measures were in place, and even when construction activities restarted gradually in mid-2020, these had to be performed with additional safeguards to manage the continuing risk of resurgence of infection. The Building and Construction Authority (BCA) became a one-stop-shop to assist the built environment sector to navigate the new COVID-safe requirements from various public agencies after the circuit breaker was lifted. BCA had to ramp up its team and coordinate information between various public agencies and the construction industry.

"Softer structures" that were in place also facilitated crisis communications and deliberations. For example, before COVID-19, BCA had regular interactions with representatives from the facilities management sector for industry development purposes. When COVID-19 struck, the relationships built up allowed for easier dissemination of key information to, and hearing feedback from, the facilities management industry. These softer structures need to be built up during non-crisis periods, with leaders identified from these industries.



**Fig 9.** The Building and Construction Authority's Restart Operations Centre that oversees the coordination of restart efforts in the built environment sector. *Image courtesy of the Building and Construction Authority.*

*Trust is relational and needs to be built up over time.*[35]

**Hugh Lim** Executive Director, Centre for Liveable Cities; and former CEO, Building and Construction Authority

Indeed, a new model of private-public partnership is being rolled out to identify new ways to chart Singapore's post-COVID-19 recovery and growth. The Emerging Stronger

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[35] Hugh Lim, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 30 April 2021.

**Fig 10.** The Alliances for Action brought together representatives from the private and public sector to exchange ideas on shaping the future of various industries in Singapore. *Image courtesy of the Ministry of Trade and Industry.*

Together taskforce has convened nine industry-led Alliances for Action (AfA) to explore, prototype and execute new ideas for various industries.[36] For instance, the Digitalising Built Environment AfA has launched a common set of data standards to encourage digital collaboration and integration of work processes across the value chain; while the Robotics AfA has developed solutions to address manpower issues and boost productivity in transport and cleaning.[37]

*At the height of the pandemic in Singapore last year, money alone could not buy us a quick-fix solution. In the end, it was the relationships and strong network of partners, both public and private, that helped us navigate through this challenge. The public sector plays a critical role in setting up the ecosystem with sound policies and good governance, while the private sector needs to own the eco system, form innovative partnerships and cross fertilise ideas to build back better.*[38]

**Wong Heang Fine** Group CEO, Surbana Jurong

*The private sector has a vital role to play in a city's resilience—because businesses are often more sensitised to trends and structural shifts that impact a city's resilience … Looking past the pandemic, the next great disruption we will face is likely to be climate change-related, so I hope the private and public sector will continue to work together to enable a more circular economy, for a greener and more resilient Singapore.*[39]

**Tan Chong Meng** Group CEO of PSA International, and Co-Chair of the Emerging Stronger Taskforce

## Observation 3:
## Communities have the instincts to self-mobilise and self-help— governments can support them by providing information and platforms to connect.

A crisis does not just test the physical resilience of a city. It also tests the social and psychological resilience of communities, which translates into the willingness of members of the community to help one another.

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[36] Emerging Stronger Together, Alliances for Action. https://emergingstronger.sg/afa

[37] Ho, Grace. "Emerging Stronger Taskforce: Alliances for Action are partnerships to drive productivity, pursue sectors that hold promise". In *Straits Times*, 18 May 2021. https://www.straitstimes.com/singapore/politics/emerging-stronger-taskforce-alliances-for-action-are-partnerships-to-drive

[38] Wong Heang Fine, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 25 May 2021.

[39] Tan Chong Meng, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 June 2021.

In some situations, there seems to be weak evidence of community mobilisation. In the early months of COVID-19, panic buying could be observed in supermarkets and grocery stores across cities, resulting in shortages of certain essential goods such as medicines and food, and even non-essentials such as toilet paper. In Singapore, as some quarantine and community care facilities had to be set up within residential estates, local concerns among residents in the neighbourhood also had to be addressed.

That said, there were also positive examples of communities in Singapore self-mobilising and starting ground-up initiatives to help one another (see Box Story overleaf for an example). Citizens, businesses and non-government organisations donated and delivered food and essentials to families affected by the outbreak. When COVID-19 outbreaks in foreign worker dormitories emerged, the government engaged with dormitory operators, NGOs and citizen-volunteers to step up care of the workers. In contrast to anxieties about quarantine facilities being set up within residential estates, there were movements expressing welcome and support for those being housed in these facilities.

*Now, we have a standing platform with NGOs to discuss issues relating to the well-being of migrant workers. During these discussions, we found that NGOs were keen to understand the various ways they could help.*[40]

**Jason Chen** Deputy Secretary, Ministry of Manpower

The government can support these grounds-up self-mobilisation efforts. Recognising the strong community response to the outbreak, the Ministry of Culture, Community, and Youth developed the SGUnited portal, which rallied Singaporeans and volunteers with resources to support a whole-of-society approach to containing the effects of the crisis.



**Fig 11.** Non-governmental organisations such as the COVID-19 Migrant Support Coalition have rallied to meet the needs of migrant worker communities, through providing meals and supplies, engagement and wellness activities, and casework assistance. *Image courtesy of Bryan van der Beek, WhatAreYouDoing.SG.*

New models for community resilience should also be built, premised on co-creation between communities and public agencies. The Centre for Liveable Cities is leading a pilot study to develop a process to strengthen local community resilience (in this case to adapt and grow in the face of climate stresses). Through a process of piloting new approaches for the co-creation of local infrastructure and environment solutions by the community, with agencies lending functional expertise, greater community ownership and social capital has been built up, for long-term resilience against disruptions.

*We need to build up the resilience in the human to self-help in crisis, not just to help the self, but to help others. Plan B is human ingenuity.*[41]

**Richard Hoo** Chief Infrastructure Planning Officer, Ministry of National Development; and Deputy CEO (Infrastructure), Urban Redevelopment Authority



**Fig 12.** Cambridge Road residents planting a green corridor in their neighbourhood as part of the Building Community Resilience initiative. *Image courtesy of the Centre for Liveable Cities.*

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[40] Jason Chen, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 21 May 2021.
[41] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.

## The Singapore Spirit: Hand Sanitisers for the Community

As COVID-19 began to take root in Singapore and local retailers ran out of sanitising products, Teck Ghee Parkview, Punggol and Choa Chu Kang residents began spotting pump bottles of hand sanitisers placed around their estate.

This initiative was the effort of various individuals and groups who banded together to provide their communities with sanitisers, face masks and alcohol swabs, with some even making the products from scratch.

In Teck Ghee Parkview, a group of women who called themselves "Teck Ghee Super Mummies" would occasionally share parenting tips or deals. But the shortage of sanitising products prompted them to come together to make sanitisers with household ingredients such as vodka and essential oils. These DIY sanitisers were installed in communal lifts with messages that encouraged the community to exercise social responsibility.

Other than bringing the group of acquaintances closer together, as more in the community were roped in to help, the initiative also contributed to stronger trust among neighbours in the community.[42]



**Fig 13.** Some of the "super mummies" from Teck Ghee Parkview housing estate making sanitisers for use in common areas in their community. *Image courtesy of Teck Ghee Parkview Facebook Page.*

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[42] Oh, Tessa. "Heroes Unmasked: No hand sanitiser? No fear. These 'super mums' are here to help". In *Today*, 16 February 2020.

**Chapter 4**

# Health and wellness
## *How can cities support better health outcomes?*

Safeguarding public health will remain a top priority as cities tackle the COVID-19 pandemic. At its most basic, the pandemic demands a public health response in providing comprehensive healthcare, public hygiene and sanitation. But it has also revealed other aspects of health that need urgent attention. This includes the exacerbation of mental stress and anxiety, and rise in chronic conditions, which have been shown to increase one's risk of severe illness if infected with COVID-19.

In the face of prolonged disruption and potential future health threats, cities need to look beyond planning for liveability to prioritising health and wellness to improve the resilience of their people. How can towns, buildings and living spaces be planned and designed for better health outcomes, and more importantly, encourage healthy lifestyles and behaviours to achieve overall well-being?

## Observation 1:
### Cleaning and sanitation, long held as a basic for public health in cities, must be continually ramped up.

When faced with the threat of infectious disease, safeguarding environmental health is an immediate priority, especially in cities. Singapore has benefitted from the long-term planning of, and investment into, its sanitation systems, services and protocols. Even so, COVID-19 has prompted the city to continually ramp up its cleaning industry and enhance its environmental sanitation standards.

That said, cleaning industries are heavily manpower-reliant, and in Singapore, a large proportion of the cleaning industry workforce is above 60 years old or non-Singaporean. This makes the industry vulnerable to manpower shortages during border disruptions, as was the case during the early days of COVID-19, or in

the medium-term, when workers may not be as readily available.

Early strategies set out in the 2017 Environmental Services Industry Transformation Map have sought to address these vulnerabilities through initiatives such as encouraging the widespread adoption of technology and job redesign. Some of these plans have been accelerated by the pandemic. In responding to the challenges of COVID-19, for example, the Environmental Public Health (Amendment) Bill was passed in late 2020 to mandate baseline environmental sanitation standards in various premises through an Environmental Sanitation Regime (ES Regime). The ES Regime requires premises to appoint a trained Environmental Control Coordinator or Officer to develop and oversee an environmental sanitation programme that ensures proper cleaning is done. Deputy CEO and Director-General of Public Health, Mr Chew Ming Fai, explained that the ES Regime creates a "sophisticated demand for cleaning services in Singapore" and encourages the market to "find a clearing price that enables everybody to make a good living from (the cleaning industry), a decent living from it".[43]

## Observation 2:
### Public hygiene initiatives must bridge awareness with community ownership and action.

Securing environmental health requires a whole-of-community effort. Aside from investing in cleaning services and technology, an important piece in sustaining public hygiene is community engagement.

In the face of COVID-19, most of Singapore's population was ready to adhere to measures such as the wearing of masks. To raise public hygiene standards, the National Environment Agency (NEA) launched the SG Clean

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[43] Chew Ming Fai, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 April 2021.

**Fig 14.** An SG Clean Ambassador reminding patrons at a hawker centre about good hygiene and cleanliness habits. *Image courtesy of Clean & Green Singapore (National Environment Agency).*

campaign to instil a "keep clean culture" amongst individuals and owners of premises even beyond the current outbreak. Under the campaign, individuals are reminded about good hygiene and cleanliness habits, while owners of premises are required to adhere to sector-specific sanitation and hygiene checklists under the SG Clean certification scheme.

However, there continues to be gaps in behaviours in maintaining the hygiene and cleanliness of public spaces. Studies on campaign effectiveness by NEA found that while the population is largely aware of messages, there is a lack of translation to consistent action. In the shorter term, initiatives to associate messaging with actions through reminders and enforcement can continue to be effective. For example, cleaning regimes in common spaces that are visible can instil confidence and serve to remind the public of the importance of hygiene.

With the pandemic timeline likely to be stretched over the longer term, improvements in personal behaviour affecting public hygiene must be sustained over time. More can be done to encourage people to take ownership of public spaces. To do so requires working with the community to affect a mindset change in internalising the shared responsibility of keeping the city clean. There is an opportunity going forward for agencies to identify and work with

community champions who understand their neighbourhoods well.[44] This would help leverage existing social capital and equip communities to take ownership over cleanliness to weather not just this outbreak but the next.

## Observation 3:
## Buildings can be better designed for, and to track, health.

There is also an opportunity for cities to explore how buildings can be equipped to safeguard environmental health. Contactless infrastructure such as facial or iris recognition at security checkpoints, automated entry and exit points can help to reduce high-touch surfaces and minimise unnecessary contact and transmission where possible. Technologies such as automatic or sensor-enabled cleaning and disinfectant systems can be part of the "new normal" requirements for facilities management. The adoption of contactless technologies and disinfection systems in buildings can form a first line of defence to curb the spread of COVID-19 in high traffic flow settings. Such technologies also help save time and alleviate further reliance on manpower in enhanced cleaning regimes. Building designs can also be calibrated

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44 Ibid.

**Fig 15.** The Sunburst UV Bot, built with a lamp module emitting ultraviolet-C light, conducting disinfection at a shopping centre. *Image courtesy of PBA Group.*

to improve their resilience to epidemics. This includes distributing densities within facilities (discussed in Chapter 5), relooking ventilation requirements to improve indoor air quality and easing environmental surveillance of wastewater. To mitigate the spread of COVID-19 in settings such as poorly-ventilated enclosed environments, public agencies have released a guidance note for building owners and facilities managers, with updated measures to enhance ventilation and air quality in indoor spaces. Recommended measures include proper operations and maintenance of air-conditioning and mechanical ventilation systems.

In Singapore's early response, scientists also found that the coronavirus was detectable in the wastewater systems of buildings, which led NEA's Environmental Health Institute to begin testing larger premises such as dormitories to reveal and respond to community spread.[45] Wastewater testing is a known method for tracing viruses and its continued usefulness highlights the opportunity for new buildings to be designed from the onset for ease of testing as a means to provide early warning of future outbreaks.[46]

*Prior to COVID-19, there was already an emerging number of wellbeing indices for buildings. With COVID-19, this trend is likely to accelerate, as landlords and tenants see the importance of having a 'safe' working environment.*[47]

**Marc Boey** Executive Director, Planning & Acquisitions, Far East Organization

## Observation 4:
Cities need to accelerate the planning and programming of their towns and neighbourhoods to encourage healthy behaviours and achieve overall well-being.

Hastened by the COVID-19 pandemic, health and wellness have come to the fore in thinking

[45] National Environment Agency, Home Team Science and Technology Agency, and National Water Agency PUB, "NEA Leads Scientific Team in Wastewater Surveillance Trials for Assessment of COVID-19 Transmission", Joint News Release, 19 Jun 2020.

[46] Chew Ming Fai, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 April 2021.

[47] Marc Boey, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 4 June 2021.

about how we plan and run our cities and neighbourhoods. Over the years, Singapore has adopted various strategies to promote healthy towns and neighbourhoods. This includes comprehensive town planning and developing

a roadmap for designing public housing estates for health and increasing access to green space (see Box Story). While the crisis has prompted early action to accelerate such plans, further points of reflection remain.

Box Story

# Planning Living Environments for Health Outcomes

## Well-Connected Neighbourhoods with Amenities

Neighbourhoods which provide a wide range of amenities such as retail, educational, community and recreational spaces help to optimise land use, and also promote health and social connection. The development of such neighbourhoods and districts has been one of the strategies deployed in Singapore's planning approach.

Singapore's public housing towns, which comprise a series of neighbourhoods, are also designed to be self-sufficient with easy access to facilities and an abundance of greenery (see Box Story in Chapter 5). Within neighbourhoods, primary schools, shops, parks and recreational facilities are within a 400 m walking distance of homes. To ensure connectivity, each town is further supported by comprehensive transport infrastructure such as pedestrian pathways and public transport networks.

Well connected, accessible neighbourhoods with a wide range of amenities encourages more active, rather than sedentary, lifestyles. To illustrate this, Hwang Yu-Ning, Chief Planner and Deputy CEO of the Urban Redevelopment Authority, explained:

*When neighbourhoods are mono-use and you need to go on a 2 km drive to get a loaf of bread, that's when the neighbourhood is not walkable, and people don't have reasons to be moving about their neighbourhood on a day-to-day basis. Whereas when you start doing a lot more mixed-use planning in the neighbourhoods, that creates impetus for people to move around the neighbourhoods, organically as part of their day-to-day living.*[48]

## Designing for Life Roadmap

Singapore's public housing towns are also set to benefit from a new focus on design for residents' health and well-being. The Housing & Development Board's (HDB) *Designing for Life Roadmap*, launched in October 2020, provides a vision of public housing living for the next decade and charts a more resident-centred approach, where plans and designs of public housing towns support residents' physical, social and mental health needs.[49]

In HDB's newest town Tengah, for instance, active design strategies are being adopted to encourage physical activity around the town. Landscaping that incorporates exploratory trails and pocket gardens will contribute towards promoting well-being. Existing towns will also benefit from the health-centred urban design strategies and policies through upgrading and rejuvenation programmes.

## Access to Green and Blue Spaces

Providing green and blue spaces that are accessible to all has been a cornerstone of Singapore's urban planning. Singapore will be restoring, extending and further integrating nature into the urban landscape as it moves towards becoming a "City in Nature". This not only makes the city-state more liveable, but also allows residents to enjoy cleaner air and water, cooler urban temperatures and improves their overall well-being. Decades of sustained efforts to green the island and conserve natural areas have enabled Singapore to become one of the greenest cities in the world,[50] with nearly 3,350 ha of nature reserves, 350 ha of nature parks, more than 350 parks and gardens, and an extensive network of

[48] Hwang Yu-Ning, "Roundtable on USS Healthy City", Centre for Liveable Cities, Ministry of National Development, 15 December 2020.
[49] Housing & Development Board, "HDB Launches New 'Designing for Life' Roadmap — Live Well, Live Smart, Live Connected", Press Release, 15 October 2020.
[50] MIT Senseable City Lab, "Treepedia: Exploring the Green Canopy in cities around the world – Singapore", http://senseable.mit.edu/treepedia/cities/singapore

**Fig 16.** Artist's impression of the Sky Sports Park, which incorporates design strategies to encourage active lifestyles, at an upcoming development in Tengah Park District. *Image courtesy of the Housing & Development Board.*

Nature Ways and roadside greenery across the city-state.[51]

By 2030, every household will be within a 10-minute walk of a park. In addition, the National Parks Board aims to establish 30 therapeutic gardens across the island, and transform around 300 km of roadside greenery into Nature Ways. The agency will also continue to partner the community to plant 1 million more trees over 10 years, and become gardeners and citizen-scientists, so that everyone can become stewards of Singapore's natural heritage.[52]

## Observation 4.1:
## Planning, design and programming need to address not just physical but mental, social and emotional well-being.

COVID-19 has been linked to the exacerbation of mental stress and anxiety. In Singapore, a study by the Duke-NUS Medical School found that one in three adults experienced psychological distress related to COVID-19.[53] There is a need for the current planning, design and programming of towns to go beyond addressing physical well-being to also address mental, emotional and social well-being, using a more granular and sensitive approach to understanding the particular needs of communities and addressing them by leveraging community assets.

During COVID-19, community spaces and facilities that engender a sense of community have proven to be crucial for social well-being. Even with public spaces shuttered for safe distancing, people continually sought spaces in the neighbourhood to socialise or simply people-watch.

And so, even as cities seek to minimise disease transmission, they should not be too quick to reduce communal spaces because of perceived transmission risk—this social infrastructure remains critical for social and mental wellness. Urban practitioners can instead explore how neighbourhood spaces can be flexibly designed and activated to allow safe socialisation and use

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[51] Nature Ways are routes planted with specific trees and shrubs to facilitate the movement of animals like birds and butterflies between two green spaces.

[52] National Parks Board, "NParks to Work with the Community to Transform Singapore into a City in Nature", Press Release, 4 March 2020.

[53] Yeli Wang, Monica Palanichamy Kala and Tazeen H. Jafar, *Factors Associated with Psychological Distress During the Coronavirus Disease 2019 (COVID-19) Pandemic on the Predominantly General Population: A Systematic Review and Meta-analysis* (San Francisco: PLOS, 2020).

even during times of disruption. Connectivity within neighbourhoods that provides the ageing population with important incidental physical activity, mental stimulation and social connection, can also be improved (further discussed in Chapter 5).

During non-crisis periods, placemaking initiatives to transform neighbourhood spaces into "moments of delight" can also support personal and community well-being. Initiatives should be simple and involve the community as much as possible.[54] Besides well-being, bringing together the community and tapping on their knowledge and assets to create quality shared spaces also builds up a store of community resilience that can be tapped on in the face of future crises.

## Observation 4.2:
## Homes need to accommodate new roles of being a place for refuge and for work.

In many cities, demand for housing and rising prices have prompted a move towards smaller dwelling units. However, with COVID-19 and the move to hybrid modes of study and working, homes and their immediate vicinities have taken centre stage in urban living and are likely to continue to do so. In lockdowns across cities, homes became the single point of refuge and doubled up as spaces of work and learning, putting pressure on the well-being and cohesion within and between households.

There is room to explore whether current residential unit configurations and sizes are suitable for the home to be a refuge in times of crisis[55], or conducive for new living and working patterns. Over the years, HDB has changed the structure of housing units, moving structural components to the sides and allowing internal walls to be removable. This gives greater flexibility for residents to create new spaces, such as a study area, in the home. Providing larger units may also be an immediate idea to increase space in homes, but there is a need balance this with higher building costs that may then affect housing affordability.[56]

Lower-cost, flexible solutions that work with existing resources in the neighbourhoods can help to address stresses in the near term



**Fig 17.** A family working and learning from home. *Image courtesy of Tan Yi Lin.*

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[54] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.
[55] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.
[56] Centre for Liveable Cities' research consultation with Dr Cheong Koon Hean.

**Fig 18.** Pay-per-use work booths at a shopping mall. *Image courtesy of the Centre for Liveable Cities.*

and boost well-being. For instance, property technology company REinvent has rolled out pay-per-use work booths in selected shopping malls, equipped with a desk, Wi-Fi, power socket and other amenities. Commercial co-working spaces have also seen a rise in popularity. While such spaces are largely located within or near the Central Business District or regional centres, there is potential to tap on or retrofit existing neighbourhood spaces such as public libraries and Residents Committee Centres to serve as co-working spaces.[57]

## Observation 4.3:
## Neighbourhoods play an important role in encouraging healthy behaviours and wellness.

While hyper-local living patterns that arose during COVID-19 lockdowns may or may not persist, they highlight the important role that neighbourhoods play in encouraging healthy behaviours. For example, early observations show that people are choosing to cook and eat at home more. This signals a need to ensure continued access to fresh produce and groceries in neighbourhoods and within walking distance for healthy meal choices.[58]

There is also more impetus than ever to enhance seamless, active mobility connections within neighbourhoods and to weave in biophilic elements from parks and green corridors. Cycling and demand for urban outdoor green spaces have both experienced a boom as residents seek recreational activities to improve their physical, social and psychological wellness.[59] The upsurge in visitors to parks in Singapore, for instance, have at times prompted park closures and increased enforcement to ensure safe distancing. Short-term means to manage crowds through extending hours of use or platforms with information on crowd levels can be explored, but in the medium-term, planners need to explore how the capacity of existing recreational spaces can be enhanced (further discussed in Chapter 5).[60]

[57] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.
[58] Loke Wai Chiong, "CLC Webinar Series: Beyond Good Healthcare: Designing Health Cities", Centre for Liveable Cities, Ministry of National Development, 21 May 2020.
[59] Dehui Christina Geng, John Innes, Wanli Wu and Guangyu Wang, *Impacts of COVID-19 Pandemic on Urban Park Visitation: A Global Analysis* (Springer-Verlag, 2021).
[60] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.

**Chapter 5**

# Cities and densities
## *Is de-densification an option?*

The COVID-19 pandemic has led some to proclaim the demise of cities and urban density.[61] [62] As cities shut their borders, went into lockdown and rolled out safe distancing measures, the agglomerations and exchange associated with cities became synonymous with transmission risk.

However, high-density cities are not necessarily at odds with safety. Density affords the efficiency and vibrancy crucial for innovation and sustainable development, and with the right measures at different scales in place, high-density cities can be designed for safety, containment and resilience. As Mrs Ow Foong Pheng, Permanent Secretary of the Ministry of National Development, pointed out:

*De-densifying the city is just not an option for Singapore.*[63]

Going forward, how can we balance the need for people to come together, and yet be able to implement safe distancing when needed? How can land-use planning and building design respond to evolving live-work-play patterns of city inhabitants to be future-ready?

## Observation 1:
## Decentralisation is a no-regrets strategy, but approaches to planning need to be flexible.

Before the pandemic, Singapore had already adopted a polycentric development approach and planned housing towns for self-sufficiency (see Box Story later in this chapter).[64] While the motivations for these approaches were for better sustainability and productivity outcomes, the COVID-19 experience illustrated that the benefits of such development went beyond reducing peak hour traffic between the Central Business District (CBD) and suburbs and boosting the quality of life.

During Singapore's circuit breaker, the accessibility to amenities at multiple polycentres and the decentralisation of facilities such as hospitals helped distribute movement patterns away from a concentration at a single city core to multiple nodes. Self-sufficient housing towns allowed people to continue accessing amenities and community support infrastructure to meet essential needs without having to travel far away from their homes, reducing peak hour congestion on public transport networks and limiting personal exposure.

In the new normal, the merits of distributing density through polycentric development are likely to remain, and it will be a no-regrets option for cities and urban planners.

It is hard to predict the exact shifts in lifestyles and economic activity that will be sustained after the pandemic. For example, whether hybrid modes of work will persist, the likely form they will take and the impact on real estate demand in and outside the CBD.

Even as cities pursue polycentric development, therefore, this should be done with more optionality and flexibility incorporated into plans.[65] One way to do this is by introducing more mixed-use planning and developments in suitable areas. For example, Singapore's CBD Incentive Scheme is designed to promote mixed-use developments to rejuvenate the CBD—older office developments may be considered for an increase in development intensity of up to 30% if they are redeveloped into mixed-use developments that include residential and hotel uses.

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[61] Teller, Jacques. "Urban density and Covid-19: towards an adaptive approach", Buildings & Cities 2.1 (2021): 150-165.

[62] Fang Wanli and Wahba Sameh, "Urban density is not an enemy in the Coronavirus fight: Evidence from China", World Bank Blogs, 20 April 2020.

[63] Centre for Liveable Cities' research consultation with Ow Foong Pheng.

[64] Polycentricity refers to the development of multiple independent urban centres of similar importance within a city. Unlike the traditional monocentric metropolis with a business core surrounded by rings of decreasing density, a polycentric city structure allows for the distribution of urban amenities across multiple nodes, creating self-contained centres where citizens can live, work and play.

[65] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.
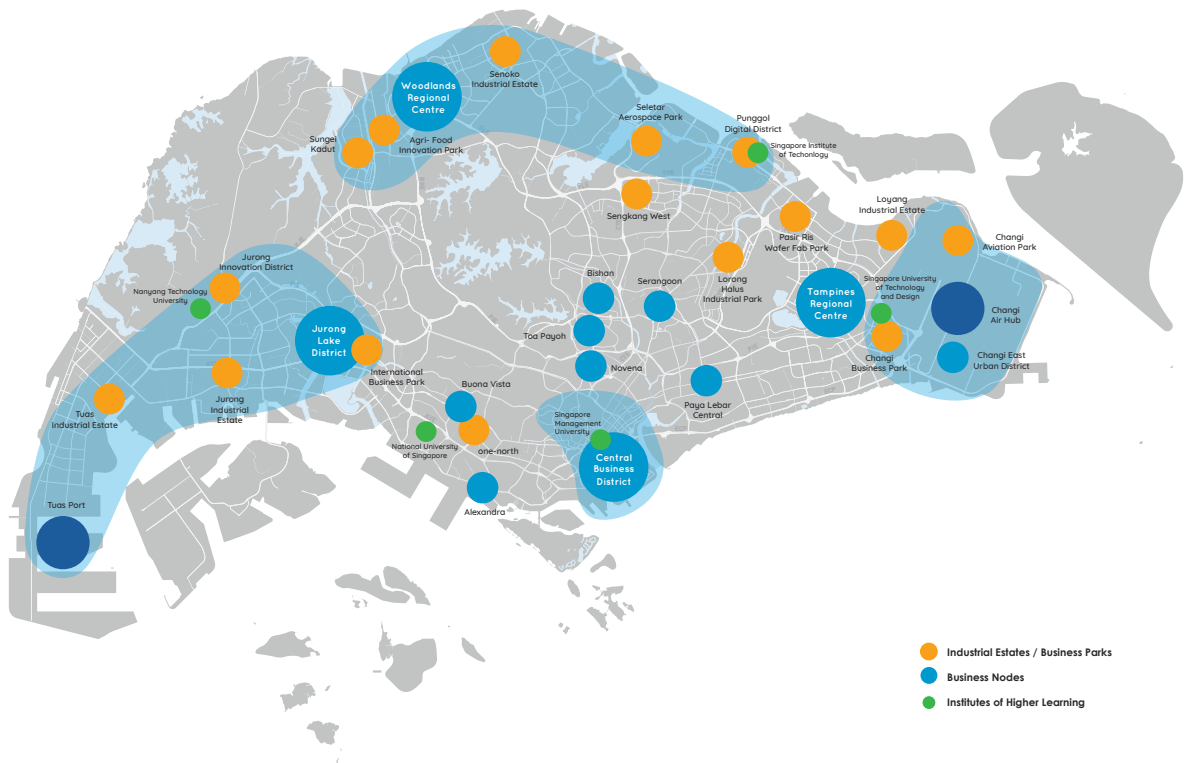
**Exhibit 3.** Singapore adopts a polycentric development approach, with regional centres in different parts of the city. *Image courtesy of the Urban Redevelopment Authority.*
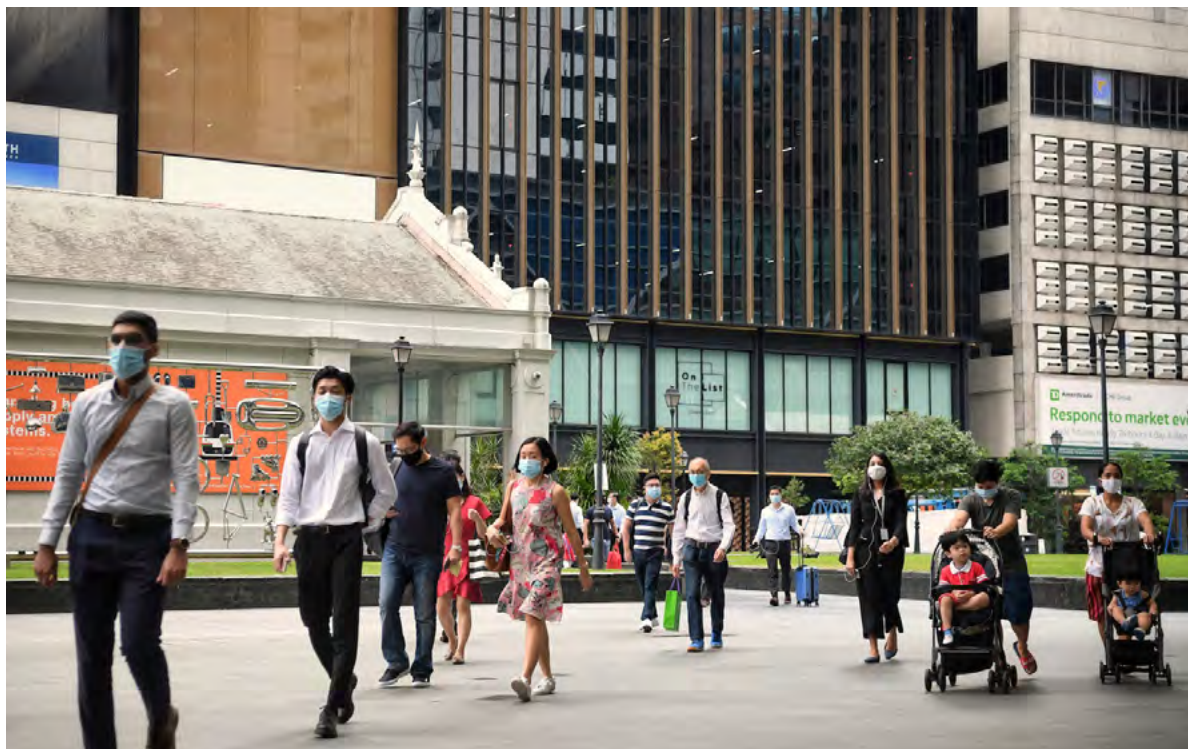


**Fig 19.** Workers in Singapore's Central Business District during the COVID-19 pandemic. *Image courtesy of Singapore Press Holdings.*

Observing the uneven impact of COVID-19 on businesses in core CBD areas versus suburban neighbourhoods and fringe areas, Marc Boey, Executive Director, Planning & Acquisitions, Far East Organization, concurred with the need for mixed-use approaches to increase live-in populations in the CBD and fringe CBD areas.[66]

Similar flexibility can be adopted in plans for polycentres, and even for generally mono-use land zoned for industry and business parks. Flexibility enables agile adaptation and adjustments to respond to different scenarios. As Hwang Yu-Ning, Chief Planner and Deputy CEO at the Urban Redevelopment Authority (URA) noted:

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[66] Marc Boey, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 4 June 2021.

*While we are not seeing very permanent shifts in live and work arrangements for cities that have 'gone back to normal' more quickly, introducing more mixed-use and polycentric development is a 'no-regrets' move. We need to plan for flexibility.*[67]

Flexibility is also important when planning for connectivity between and within polycentres. Cities such as London, Paris and New York have used the pandemic-induced cycling boom to advance ongoing plans to promote active mobility as a safe and green mode of transport. Yet, while initiatives such as "road dieting" may be a straightforward response to enable more active mobility, they risk shutting out possibilities of experimentation for future mobilities that may be safer and more efficient, such as autonomous green electric buses. Retaining flexibility and infrastructure for such experimentation thus remains important and may bear solutions that are more fruitful for Singapore.[68]

Box Story

## Planning for Polycentricity and Self-Sufficiency

Singapore's polycentric model is not new. It is a result of a decentralisation approach taken in the past that has led to the regional and sub-regional centres seen today.[69]

At the city-scale, the idea of decentralised growth and development has its roots in the 1991 Concept Plan. Concept Plans are Singapore's long-term land use and transportation plans that guided physical development over a 40-50-year horizon. The 1991 Concept Plan introduced the "constellation concept", a hierarchy of commercial centres around the island to bring jobs closer to homes and reduce congestion at the city centre. These regional and sub-regional commercial centres were sited away from the city centre and were planned in close alignment with the transport network to facilitate easy movement. Centres were to be served by a network of expressways and the Mass Rapid Transit (MRT) system. The city structure Singapore has today, with regional centres Woodlands, Tampines and Jurong East, are a legacy of the 1991 Concept Plan.



**Fig 20.** Jurong Lake District, which will grow into Singapore's largest mixed-use district outside of the city centre over the next 30 years to cater to changing needs of businesses and people with the rise of the digital economy. *Image courtesy of the Urban Redevelopment Authority.*

[67] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.
[68] Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.
[69] Centre for Liveable Cities' research consultation with Dr Cheong Koon Hean.

At the neighbourhood and town planning level, comprehensive town planning began in the 1960s to support a quality lifestyle. Singapore's public housing towns, planned and developed by the Housing & Development Board, are designed to be self-sufficient, with easy access to shops, schools and social and recreational facilities, and an abundance of greenery. The development of such towns is guided by four planning principles: (1) the neighbourhood concept; (2) hierarchy of facilities; (3) planning for connectivity; and (4) the checkerboard concept.

Under the neighbourhood concept, each town is anchored by a town centre that serves as the key commercial and activity hub. Surrounding this main town centre are smaller neighbourhoods of about 4,000 to 6,000 residential units in size served by local facilities such as shops, schools and integrated facilities. Each neighbourhood further comprises precincts of 400 to 800 residential units that are also served by shops and precinct facilities such as fitness corners and community gardens. Facilities are distributed based on a hierarchy concept, with town-level facilities such as large supermarkets and sports complexes catering to wider needs and serving a wider catchment, while local-level amenities with a mix of smaller stores and eateries are provided at the neighbourhood and
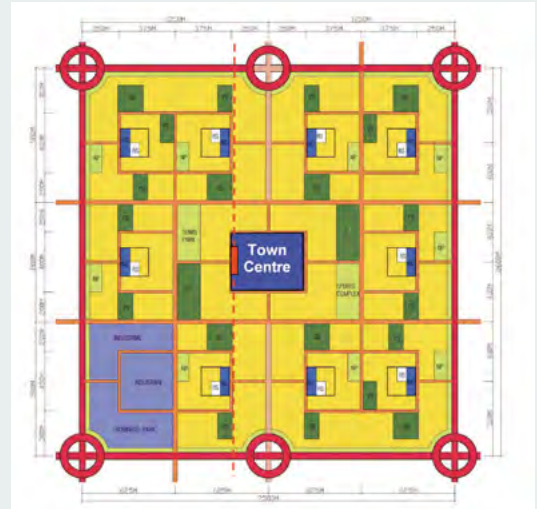


**Exhibit 4.** A schematic drawing showing the checkerboard planning concept for Housing & Development towns. *Image courtesy of the Housing & Development Board.*

precinct level to meet residents' daily needs. New neighbourhood centres today also comprise smaller malls that count larger retailers in their tenant mix.

To ensure connectivity, each town is supported by comprehensive transport infrastructure. Within towns, cycling and pedestrian networks provide convenience and connectivity. Blocks are also planned to have access to a bus stop or MRT/Light Rail Transit station to connect residents to other parts of Singapore.



**Fig 21.** Residential towns are supported by transport infrastructure. *Image courtesy of Dongli Zhang.*

## Observation 2:
## Densities within neighbourhoods need to be managed and self-sufficiency enhanced through a mix of planning and programming.

As people spend more time in their neighbourhoods, there has been an increased load on the capacity of amenities such as parks and malls, forming hotspots of crowds. To ensure safe distancing, the density of activities within neighbourhoods needs to be redistributed. Public agencies and facility managers have sought to manage crowd levels by limiting entry, deploying ambassadors for safe distancing and tapping on technologies such as drones and robot dogs. Online portals with real-time data on crowd levels such as URA's Space Out and Safe Distance @ Parks have also been rolled out to enable residents to make informed choices on the risk of exposure before visiting amenities.

To manage density of activities, the capacity of facilities could also be increased by extending

their usable hours. Parks, for example, see the highest visitorship levels during the cooler periods of the day and the lowest during the afternoon and night. Small-scale interventions such as better night lighting or shading could help to extend the period of time parks can be used, distributing crowd levels across time.[70]

In the longer term, and as a response to COVID-19 and the climate crisis, the concept of 15-minute cities—where residents can reach most of their needs in 15 minutes—has regained popularity amongst urban planners. Paris and Melbourne have begun promoting the idea of 15/20-minute cities for local living as a way to "build back better". In Singapore, the self-sufficiency of towns and neighbourhoods has been a mainstay in its town planning since the 1960s (see Box Story).

That said, more could be done to strengthen the self-sufficiency of housing towns. As Richard Hoo, Chief Infrastructure Planning Officer at the Ministry of National Development, and Deputy CEO at URA, noted, there is still an opportunity to "explore what other kinds of decentralised facilities we need and to start providing for them".[71] This may include the provision of conducive workspaces, more public spaces



**Fig 22.** Cyclists making use of the extensive cycling network in Punggol town. *Image courtesy of Jimmytst.*

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70 Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.
71 Richard Hoo, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 3 May 2021.

and appropriately sized commercial nodes even in private residential neighbourhoods[72] which, as discussed in Chapter 4, are important ingredients to a town's self-sufficiency (as well as social infrastructure for well-being).

Within towns, connectivity can also be improved, in particular for the ageing population. The pandemic showed that disruptions to everyday living disproportionately affect certain groups of people, particularly seniors. With many cities expecting to see a much larger senior population in the future, there is a need for existing parameters for connectivity—such as a 10-minute walk—to be planned with an older demographic in mind, serving seniors living in both public and private housing neighbourhoods. This is where data on the movement patterns and experiences of seniors (and other vulnerable groups) may be useful in supporting an evidence-based, fine-grained approach to planning neighbourhoods. As Hwang Yu-Ning, URA Chief Planner and Deputy CEO, pointed out:

*One of the strengths of the Singapore system is that we have very strong collaboration with the research community… We are looking, through the research, at seniors, to see what motivates them in terms of their movements within a space and within the city, and to audit the existing environment and plan new areas, so as to create age-friendly neighbourhoods.[73]*

## Observation 3:
## Densities within buildings can be addressed through enhanced standards and designs.

City dwellers spend 90% of their lives in indoor settings, and this has further increased as more shelter at home during the COVID-19 pandemic. It is thus important to plan and manage internal densities at the building level, such as through segregation and compartmentalisation of spaces. Providing features such as conveniently-located federated lockers or bigger mailboxes at the doors of homes will also help to reduce the frequency of physical contact.

Mass communal living facilities such as dormitories, nursing homes and hostels pose a public health challenge in the urban setting, as they have a higher risk of transmission of communicable diseases. From April to August 2020, Singapore faced its largest outbreak of COVID-19 in several migrant worker dormitories that housed workers from the construction, manufacturing and marine shipyard sectors. The communal nature of dormitory living was identified as one of the reasons that contributed to a spike in cases. This highlighted an urgent need to enhance the design of



**Fig 23.** Migrant workers playing pool and foosball with volunteers at Terusan Recreation Centre. Recreation Centres sited near dormitories offer a range of activities and amenities for migrant worker communities. *Image courtesy of Singapore Press Holdings.*

[72] Marc Boey, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 4 June 2021.
[73] Hwang Yu-Ning, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 14 April 2021.

dormitories to future-proof them against infectious disease outbreaks.

New standards have been piloted in temporary Quick Build Dormitories. These standards included improved living space per resident, room occupancy caps and en-suite toilets.[74] These enhancements help to modularise living spaces to reduce the size of possible transmission clusters. Wi-Fi was also included to support the mental well-being of workers if they had to be quarantined in their rooms during an outbreak. In addition to infrastructural changes, agencies have put in place contact tracing, which has enabled them to more accurately identify, isolate and quarantine close contacts of cases, as well as identify areas of improvement in dormitory management practices to prevent and control infection.

In the longer-term, agencies are conducting a holistic review of the standards to improve the public health resilience and liveability of future new dormitories, considering that any new disease outbreak could be very different from the existing one. The review and development of new standards will take into consideration the views of various stakeholders including public health experts, employers, migrant workers, dormitory operators and non-governmental organisations.

Another key focus area is the management of nursing homes. In Singapore, nursing homes were identified as high-risk as they are not only designed for communal living but also serve a vulnerable segment: seniors, who are at higher risk of developing serious health complications if infected with COVID-19. Mass testing was conducted for all residents and staff as part of efforts to detect infections early and ringfence any possible clusters. Additionally, as part of prevention measures, there was a mandatory implementation of split zones to minimise the mingling of staff and residents early on in the pandemic. Zones were designed to create a self-sufficient care "bubble" with a fixed set of staff and residents who were not allowed to intermingle. All communication between staff was also conducted over text messages, by phone, or via video conference. Furthermore, the usage of common spaces such as pantries and lifts were also staggered to ensure sufficient time for cleaning between use by personnel from different zones.[75] Staff who had any interaction with residents were also required to live apart from their families in hotels or at accommodation facilities in their workplaces to reduce chances of transmission.

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[74] Government of Singapore, "Improved Standards of New Dormitories for Migrant Workers", 8 June 2020.
https://www.gov.sg/article/improved-standards-of-new-dormitories-for-migrant-workers
[75] Wan Chen K Graham and Chek Hooi Wong, *Responding to COVID-19 in Residential Care: The Singapore Experience*. LTCOVID country report, International Long-Term Care Policy Network, CPEC-LSE, 27 July 2020.

**Chapter 6**

# Digital technology
## *An enabler for urban resilience?*

With COVID-19 greatly disrupting "normal" ways of living and working, technology and digital services have become crucial in providing new and safe ways to connect and access urban services.

Some of the solutions developed in direct response to COVID-19, for instance, will have continued application to urban services in the new normal. Examples from Singapore include VigilantGantry, a fully automated, contactless gantry system for temperature screening to improve the rate of contactless scanning, ease bottlenecks in long queues outside buildings and reduce the manpower required for temperature screening measures; SupplyAlly, a solution for the management of a flexible pool of supply-distributing volunteers and the tracking of collection quotas; and various chatbots that keep the public updated on critical news and information.

Beyond these solutions, in general, cities of the future will need to accelerate their digitalisation plan to integrate smart, digital solutions into the lives of citizens and residents across age groups. How might cities do so?

## Observation 1:
### Cities need to incorporate foundational infrastructure to support the delivery of digital services.

The swift application of technology in Singapore's COVID-19 response was aided by the high rate of mobile phone adoption and Singapore's steady investment in building its digital foundations over the past few years in areas such as widespread broadband networks, including within buildings. Efforts in this area have been spearheaded by the Smart Nation initiative, launched in November 2014 to harness and apply digital technologies in a systemic and coordinated way to bring together the public and private sectors to improve lives and economy.[76]

With the growing need to digitalise urban living in the wake of COVID-19, cities of the future will need to consider how physical infrastructure may need to be planned to support new digital infrastructure and platforms, and if smart home technology may eventually need to be considered a fundamental infrastructure for residents, in the same way as broadband provision has come to be.

For example, with approximately 80% of Singapore households living in public housing, public agencies are working with industry players to develop and test smart home solutions in public housing estates. These are part of the Housing & Development Board (HDB)'s Smart Town approach, which aims to push the technological frontiers of public housing in five areas: planning, environment, estate, living and community.[77] For instance, the Punggol Northshore development by HDB provides smart-enabled public housing flats where residents can tap on commercial smart applications such as for the management of energy consumption and monitoring of the elderly at home.

There are also opportunities to transform the delivery of services such as facilities management, a traditionally workforce-intensive sector. Integrating data analytics with mechanical and electrical systems can help to reduce reliance on workers and transform the sector to a higher-value one.[78]

Another case study of future foundational infrastructure is the Punggol Digital District, which will be Singapore's first business park to offer businesses plug-and-play digital infrastructure through the Open Digital Platform (ODP), a smart city platform co-developed by

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[76] Centre for Liveable Cities. "Introduction: Enabling Development Through Digitisation". In *Technology and the City: Foundation for a Smart Nation*. Singapore: CLC Urban Systems Studies, 2018, 1.

[77] Smart HDB Town, Housing & Development Board. https://www.hdb.gov.sg/about-us/our-role/smart-and-sustainable-living/smart-hdb-town-page

[78] Wong Heang Fine, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 25 May 2021.

ST Engineering, JTC Corporation, Government Technology Agency (GovTech), Cyber Security Agency of Singapore and the Infocomm Media Development Authority.[79] The ODP will connect various digital subsystems within the district, from building management to access control and energy optimisation. Not only will this provide a view of what is happening across the estates for better operational management, collected data in the ODP can also be made available to companies, students and the public, to test out new concepts of living, working and delivering services in the district.

## Observation 2:
## There is increasing opportunity for both public sector and private sector digital innovation to meet the need for urban services.

To respond to the challenges of COVID-19, GovTech has been swiftly rolling out various digital tools to support public health and safety in Singapore, and more effective communication to a wide audience.[80] [81] [82] This includes:

— Technology for timely and comprehensive communication

• Application of artificial intelligence technology for the government to deliver timely updates in Singapore's four official languages via its WhatsApp and Telegram channels.

• Postman, an alternative government alert system that can alert its approximately 4 million subscribers with updates within 30 minutes, that is, at 500 recipients per second.

• In three days, GovTech built a chatbot to answer questions from businesses and employers about policies related to the outbreak.

— Technology for ease of public health regulation and administration

• The development of apps such as TraceTogether and SafeEntry to monitor and manage the inflow and outflow of human traffic islandwide, for health surveillance purposes. This was further augmented by an AI temperature tool (iThermo), developed by the Integrated Health Information Systems in two weeks through partnering



**Fig 24.** Visitors using an automated TraceTogether check-in gantry to enter a shopping mall. *Image courtesy of Singapore Press Holdings.*

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[79] "Punggol to be a full-fledged Smart Town", Smart Nation Singapore. 31 May 2021.
[80] http://go.gov.sg/opensource
[81] Open Government Products. http://open.gov.sg
[82] Overview — Digital Solutions for a 21st Century Pandemic, Developer Portal. https://www.developer.tech.gov.sg/technologies/digital-solutions-to-address-COVID-19/overview

with a local startup to adapt a commercial wound-scanning device. This made check-ins faster while also increasing safety for all involved.

- GovTech also built PaySG, which allows travellers to pay for swab tests and quarantine stays without having to exchange cash.

- Other applications to help agencies facilitate quarantine management and contact tracing processes.

GovTech has been able to deliver these solutions with very short development runways of less than two days to three weeks. This speed and agility stem from GovTech adopting development models similar to those of modern technology companies. Staff are organised in small product teams of two to six members, with decision-making delegated to the team itself. Prototyping and iterative approaches are adopted, using "off-the-shelf" modules where available and adapting these to solve the immediate challenges.

To further accelerate and improve product development for the COVID-19 response, GovTech also leveraged public participation, launching a tech volunteer drive in 2020 to get help on COVID-19 tech projects for the government. Over 600 people responded to this call, and 50 of them were onboarded into existing teams to accelerate and support the product development process. An additional 330 participants took part in the GovTech COVID-19 Idea Sprint to prototype solutions to issues highlighted by various public agencies.



**Fig 25.** A customer making an e-payment at a hawker stall. *Image courtesy of the Centre for Liveable Cities.*

**Fig 26.** A food delivery rider fulfilling an order. *Image courtesy of kandl stock.*

Besides GovTech, other agencies also deployed technology in managing public health risks within their domains. For example, the National Parks Board launched a website that tracks crowd levels at each park so that Singaporeans can avoid more crowded parks. The Urban Redevelopment Authority's Space Out website similarly tracks crowd levels at malls, supermarkets, post offices, parks, and sports and recreational facilities islandwide.

The private sector and civil society also responded to the challenges and needs posed by COVID-19, rolling out new platforms and apps such as e-payments for hawkers, delivery services and cloud kitchens, and community-based apps to match volunteers with seniors needing help. Some of these new solutions have implications for how we plan and operate our cities. For instance, cloud or ghost kitchens are not new in Singapore but their growth has been accelerated by COVID-19, as more people make use of food delivery services. Another example is from Surbana Jurong, which has been working with Singtel to provide "phygital" (physical-cum-digital) solutions catering to medical facilities, community-based care and assisted living facilities.

## Observation 3: Technology must be accessible to all.

The effectiveness of digital solutions for the health and resilience of a city often depends on their acceptance and use by a large part of the population. For instance, the effectiveness of the TraceTogether contact tracing app and SafeEntry, a national digital check-in system for visits to places, requires active participation by residents, which in turn requires trust and transparency.

To increase awareness and adoption of technologies across various population segments, Digital Clinics have been conducted to help participants with the use of smartphones and Government apps. Singapore's Infocomm and Media Development Authority has also initiated a "Smart Nation Ambassador" programme to mobilise early tech adopters to engage the wider public in adoption of digital solutions.[83]

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[83] "A Singapore Government that is digital to the core, and serves with the heart", GovTech Singapore, 30 December 2020. https://www.tech.gov.sg/files/media/corporate-publications/dgb-public-document_30dec20.pdf

## Conclusion
# Resilient cities in the new urban normal

COVID-19 has hit cities hard. Yet cities are, and will continue to be, hubs of innovation and engines of growth; places where people can enjoy diverse and rich experiences and interactions.

How might cities adapt and prepare themselves not just for a potential future Disease X, but other stressors and shocks? What are the opportunities for how we plan, develop and programme our cities in the new urban normal?

### Investing in whole-of-society resilience

When the pandemic first struck, cities needed to rapidly roll out infrastructure for quarantine and to stockpile essential goods, amidst much uncertainty about the coronavirus and how it would affect communities. Cities also needed interventions in their built environment to promote safe distancing and a clean and safe environment. Such just-in-time responses are actually only possible if cities have invested in resilience, such as developing emergency preparedness mechanisms, and investing in just-in-case facilities and spaces.

*The scale of future disasters might be much bigger than we ever had to deal with. Do we have the mechanisms to stand up in a very short time?*[84]

**Hugh Lim** Executive Director, Centre for Liveable Cities

This pandemic has also highlighted the importance for cities to invest in sufficient social infrastructure such as healthcare and other services, to support all communities in a city. Otherwise, a crisis will bring uneven outcomes, as well as a crunch and competition for resources.[85] Importantly, trust and collaboration across society need to be built up over time.

*COVID-19 showed us that resilience also means acknowledging our interdependency—we may fall sick as individuals, but we can only claim recovery as a country when everyone is safe.*[86]

**Tan Chong Meng** Group CEO, PSA International

*It is critical to build social capital and to persuade citizens to be part of the solution, so that they will chip in to help each other cope with new vulnerabilities.*[87]

**Dr Cheong Koon Hean** Chairman, Centre for Liveable Cities

### Re-thinking planning paradigms

Beyond the short-term emergency response, COVID-19 has shifted the way we live, work, play and learn.

For instance, while contributors cautioned that it is too soon to conclude what the net effect of working-from-home arrangements will be on real estate demand in the longer term, it is clear that COVID-19 has accelerated digitalisation in our cities. Digitalisation presents opportunities for greater agility in how we plan and programme our cities—more spaces will perform

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[84] Hugh Lim, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 30 April 2021.

[85] Ibid.

[86] Tan Chong Meng, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 1 June 2021.

[87] Centre for Liveable Cities' research consultation with Dr Cheong Koon Hean.

**Fig 27.** As the city and its people adapt to a new normal, what planning paradigms do we need to rethink? *Image courtesy of Andrew Koay, Mothership.*

multiple purposes, and digital platforms will be leveraged to create places that are more engaging and flexible. The pace of technological changes also raises expectations for city rejuvenation. For example, city centres may be reinvented with a greater emphasis on experience and innovation, with a larger live-in population, rather than being primarily a corporate or business centre.

*Too many voices are prophesising 'the end of the city' as a result of COVID-19 and the rapid digital acceleration. I don't see that. While technology enables us to optimise physical space, it does not replace it... Rather, digitalisation will reinforce and reignite the role of place.*[88]

**Professor Greg Clark** Chair, Connected Places Catapult

Similarly, while hyper-local living patterns that arose during COVID-19 lockdowns may or may not persist, they highlight the important role that neighbourhoods play in liveability. In the new normal, cities will need to consider how to create better, healthier, more inclusive neighbourhoods, with a mix of uses that support work and leisure near the home.

### Building back greener

*Resilient cities promote sustainable development, well-being and inclusive growth.*[89]

**Wong Heang Fine** Group CEO, Surbana Jurong

Importantly, the pandemic can serve as a spur for cities to "build back greener". Climate change is already an on-going stressor to cities, and its impact on liveability will get worse if left unmitigated. COVID-19 has only emphasised the importance of accelerating cities' sustainable development.

This encompasses two aspects. First, cities need to continue to protect, invest in, and leverage on its natural capital. During lockdowns across cities, residents found much-needed respite in the green and blue spaces in their cities and neighbourhoods. Expanding urban farming is a particularly valuable approach, not only to incorporate pockets of greenery throughout the city, but also to play a part in supporting urban food resilience.

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[88] Clark, Greg, "Pioneering the Post-pandemic City", *Urban Solutions*, June 2021.
[89] Wong Heang Fine, "Interview with CLC", Centre for Liveable Cities, Ministry of National Development, 25 May 2021.

Secondly, cities need to continue to push for sustainable development by encouraging "green" buildings, moving towards renewable energy, and accelerating circularity in the city, among other initiatives. To support this green growth, cities will need to continue to host and promote innovation in its urban systems.
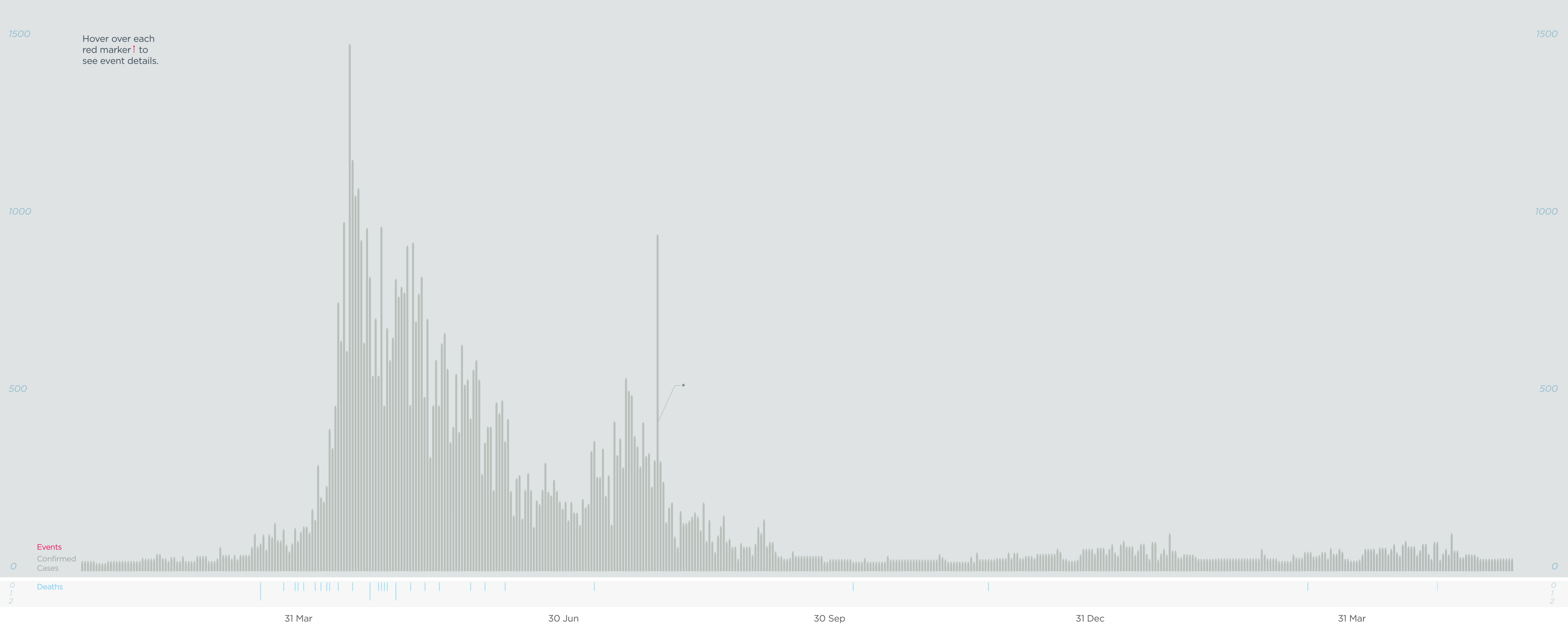
The higher density of cities should not be seen as a liability—in fact, it is the agglomeration of people, ideas and economic opportunities that gives cities the best chance of success, and the ability to bounce back better from the pandemic.

## Key Events in Singapore's COVID-19 Response

The first COVID-19 case in Singapore was reported on 23 January 2020. Between that time until 21 May 2021, there have been 61,770 confirmed cases of COVID-19, with 32 deaths.

As of 9 May 2021, some 3,137,330 vaccine doses have been administered. This timeline highlights key events in the unfolding pandemic, and Singapore's whole-of-society response.

Hover over each
red marker ↑ to
see event details.

1500

1000

500

Events
Confirmed
Cases
0

Deaths

31 Mar          30 Jun          30 Sep          31 Dec          31 Mar

* The spike in reported cases on 5 August 2020 was a result
  of testing carried out to clear dormitories of COVID-19.