How we can better chart Singapore's urban future

While Singapore faces demographic challenges, climate change and technological disruptions, it can continue to improve its good living environment through long-term planning and innovative urban solutions, said Housing and Development Board CEO Dr Cheong Koon Hean.

Among others strategies, the Republic can adopt a concept of creating a virtual cycle of land recovery, thus enabling a constant rejuvenation of Singapore for future generations, she said in delivering an IPS-Nathan lecture on Tuesday (April 10). Below is an excerpt from Dr Cheong's prepared speech for the lecture, her second in a series of three lectures.

Cheong Koon Hean
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The city state of Singapore, at just 720 square kilometres, is about half the size of metropolitan London.

Yet it has to house many facilities to support its economic and social growth, including major uses such as airports and ports, energy, waste and water management and military infrastructure, all of which are needed to support a sovereign nation.

Going forward, Singapore will face challenges from demographic changes, climate change and technology disruptions. How can it continue to build an attractive urban future with a good quality of life for its people?

Today, Singapore already adopts a long-term strategic planning approach. It is crucial that Singapore takes a long-term view when it plans.

Given our land constraints, we need to develop strategies that will safeguard sufficient land to meet our development needs way into the future.

We now formulate strategic 'Concept Plans' with a long-term perspective of 40 to 50 years. Such plans focus on the strategic broad strokes rather than details, attempting to safeguard land for all the major land uses and key urban infrastructure (especially transport infrastructure) to support growth.

The Concept Plan is reviewed roughly every 10 years to keep pace with changing needs, with additional reviews done by agencies internally where required. So far, four Concept Plans have been prepared in years 1971, 1991, 2001 and 2011.

Phased medium-term plans are also worked out to help decision makers make the necessary trade-offs between competing land uses and to prioritise infrastructure investments to support physical growth.

The Concept Plan is cascaded to a statutory detailed Master Plan with a shorter horizon of about 15 years. The Master Plan maps out detailed land uses and the maximum plot ratio or density allowable for each site, and is reviewed every five years. The legislated Master Plan provides transparency and certainty to the private sector to guide their development and business decisions.

The formulation of the Concept Plan is a highly complex exercise which requires a 'Whole-of-Government' effort. Inter-Ministry committees are formed, looking into matters of population,

housing, transportation, commerce and industry, central area planning, environment and recreation.

The plans are not static; the assumptions and projections are revisited regularly and the strategies adjusted where necessary. This 'Whole-of-Government' approach is critical as urban issues become increasingly complex and difficult trade-offs have to be made.

The formation of the Prime Minister Office's Strategy Group is also timely, to identify and coordinate national priorities early and to translate them into policy action plans.

This institutionalised process has been a key factor in enabling many of our plans to be realised.

Going forward, what might be some strategies which we could consider in planning for our future? Let us examine some of these.

Adaptive lifecyle planning

Singapore is in transition into 'early middle age'. As our island becomes more built up in the next few decades, how can we secure land for future development? I would like to introduce the idea of 'adaptive lifecycle planning'— a concept of creating a virtual cycle of land recovery, thus enabling a constant rejuvenation of Singapore for future generations. Let me expand on this concept.

Rejuvenation through recycling land

Similar to many mature cities, as we become built up over time we will be left with more brownfield rather than greenfield sites. This requires us to shift progressively into an 'urban redevelopment/regeneration' mode.

For an island city-state limited by our territorial waters, available land for new development will come mainly from 'recycling' existing land and properties.

Given this, perhaps our long-term planning horizon should be stretched beyond the Concept Plan's current 40 to 50-year horizon to even 100 years to capture opportunities for potential redevelopment beyond the economic and useful lifespan of existing buildings and infrastructure.

By doing so, we would be able to secure land for rejuvenation to meet the needs of future generations. Some may say that this proposal runs counter to the need to be flexible in a very uncertain world.

However, I would argue that 'lifecycle planning' would stretch our imagination and open us to future possibilities.

If we think sufficiently long-term, the fixed constraints today, even large existing developments like airports, would be sufficiently depreciated in the longer-term to allow for major moves in our plans.

Taking a longer-term view will also enable us to factor in the investments needed for costly infrastructure so that we can build up our fiscal resources over time.

Of course, the plans would have to be reviewed regularly and updated to respond to dynamic changes.

Our system of leasehold land is key to enabling such land rejuvenation to take place.

For example, industrial land which are generally on 30 to 60 year leases can be recovered when their lease ends. The land can then be re-used to meet new needs and support new economic thrusts in the next lease cycle.

We see many successful examples of such urban regeneration in the world. For example, London and Bilbao are examples where port land, which is no longer needed, is redeveloped for new commercial, residential and cultural uses.

Similarly, we are re-locating a large part of our port after some 50 years. PSA announced last year that it would be moving its Tanjong Pagar terminal to Pasir Panjang soon and eventually, to the Tuas mega port.

This new state-of-the-art port is slated to be operational from 2021 and fully ready by 2040. This shift will eventually free up much of the southern waterfront for future residential, commercial, and leisure and recreational opportunities.

In another example, the move of the military airbase at Paya Lebar to Changi in the future will free up 800 hectares for new developments.

These 'musical chair' moves are an essential strategy for rejuvenating our physical landscape. But to make changes to spatial patterns, we have to plan well ahead of time. A few large pockets of land need to be safeguarded to initiate these big moves.

Build adaptability into planning

Being adaptable means that we should provide for 'modularity and flexibility' in our plans, in view of future uncertainties.

For example, even though we have safeguarded a large tract of land in Tuas for our port, it could be phased to retain strategic flexibility, in case demand for port activities does not pan out as envisaged.

Building flexibility into our plans also requires us to develop plans which can accommodate a larger population. Dr Liu Thai Ker has advocated planning for a projected population of 10 million.

His view has generated debate. No doubt, there will continue to be much discussion on what might be an appropriate population size for Singapore.

This largely depends on whether we can find innovative urban solutions to sustain our good living environment, and on the level of acceptance by our citizenry.

Regardless of public sentiments, it is wise to plan for scenarios with varying population sizes, as it would help planners to anticipate the types of infrastructure that will be needed, the appropriate densities to build on available land, and to work through the many difficult trade-offs in allocating land amongst competing uses.

If the population growth does not materialise, we would have a happy situation of having more land buffer set aside and more choices in the use of land.

Develop 'no regrets' infrastructure and pursue land/space creation

When future demand is uncertain, how should we provide hard infrastructure which, once built, cannot be changed? One strategy is to plan for and invest in selected 'no regrets' infrastructure upfront, even if it might result in some redundancy and sub-optimisation.

One example is the MRT rail network.

Planning for more rail lines in anticipation of a larger population would enable us to safeguard the land for the rail corridors now before the city gets more built up. In fact, this was how we managed to build many of the existing MRT lines today.

Our long-term planning approach meant that we had safeguarded the land corridors for many of our MRT lines since the 1970s. Sizing upfront a capacity with sufficient buffer for growth is an important consideration because once the railway line and MRT station is built, any attempt to upgrade capacity is extremely costly, if not impossible.

A second example is land creation—where possible, we should build up a land bank because in Singapore's context, 'more land is better than less land'.

An illustration of good planning foresight is the reclamation of land at Marina Bay since the 1970s in anticipation of the future growth of the city.

This alleviated growth pressure on the existing city, and enabled us to conserve many of our historic districts. However, the extent to which we can reclaim land is limited by our territorial boundaries as we have to also preserve sea space to support our port functions.

We should therefore explore other means of space creation as well.

JTC has successfully implemented the Jurong subterranean caverns for liquid storage. The government is looking into the development of more underground space.

Opportunities exist in areas like the ground beneath Kent Ridge or the Science Park where the soil formation underneath is suited for such underground construction.

In collaboration with partner agencies, the Urban Redevelopment Authority (URA) is currently developing an Underground Master Plan, which it said will be announced in 2019.

We could also consider decking over large swaths of transport infrastructure, such as highways and MRT depots that take up extensive tracts of land.

There are many successful examples where this has been done. Klyde Warren Park in Dallas was created by decking over highways.

The Millennium Park in Chicago and the new park at Hudson Yards in New York straddles a working railyard.

Co-locating uses can also save land. The East Coast Integrated Depot, a new 36-hectare S$3.2 billion depot will be built to house 220 trains for the Thomson-East Coast Line, East-West line and Downtown line.

Said to be a world's first, the depot will also house 550 buses. By integrating the depots, the Government expects to save 44 hectares of space, or about 60 football fields. It will be completed by 2024.

These strategies use 'capital and technology' to overcome our limitations in land. The challenge is to find the right economic model to justify these expensive investments.

For example, we were able to justify sinking the Marina Coastal Expressway underground because it would free up more prime land with access to the waterfront, and enhance overall land value. Similarly, decking over infrastructure use would create additional space and free up land elsewhere for other uses.

Such projects should be seen as investments in our future.

Build in greater flexibility in regulations and design

Planning regulations convert our land use plans into working rules to steer developments towards specific planning objectives. Being adaptable is about building in more flexibility to our zoning regulations to cater to the changing work patterns and market needs arising from the sharing and the digital economy.

When we planned Marina Bay, we introduced the 'white site' zone where we stipulated a minimum floor space for a specific use, such as a hotel, and then left it to the market to determine the remaining types of uses according to demand.

The type of use could also be changed over time to meet evolving needs. More white sites could be considered as we open up newer mixed-use areas.

Recently, URA introduced an innovative zoning approach for the new Punggol Digital District—a district set aside for digital and cyber-security industries.

Zoning rules would be applied at a district level instead of on individual parcels of land, giving developers more flexibility to mix uses. Just as cities need to be adaptive, so should buildings be designed for greater flexibility.

Reasonably sized floor plates, wider structural spans and sufficient floor to ceiling heights would allow a building to be converted and repurposed for a variety of uses over time.

For example, Google's new Mountain View headquarters comprise a series of giant domes under which any number of structures, fit for any purpose can be quickly assembled, making it completely programmable for any use case.

Infrastructure as an integrated, resilient and intelligent urban system

Today, based on our Concept Plan's projections, individual agencies make provision for key infrastructure such as those covering transport, water, energy generation and waste management.

Going forward, there is scope to rethink infrastructure as 'urban systems' and not just as specific stand-alone types of infrastructure, so that we can achieve closer integration and greater synergies between them.

As a small island city-state, we should work towards three important principles in our infrastructure provision: a) To favour a circular rather than a linear model; b) To adopt an integrated multi-function rather than a single function system; c) To build resilient and intelligent urban infrastructure.

One of the best examples of a circular system is the way in which the Public Utilities Board (PUB) has successfully closed the 'water loop'.

Today, Singapore is designed as 'one giant, rain-water absorbing sponge'.

PUB has developed a whole network of drains, canals, and underground storage tanks to capture rainfall. Through the introduction of the Deep Tunnel Sewerage System, PUB is also capturing all used water and is recycling it into NEWater, most of which is used by industries that require very clean water.

Similarly, we should think of 'multi-functional' strategies in say, land reclamation. For instance, in the future reclamation of land along the East Coast and the Southern Waterfront, the reclamation could double up as a 'dam'; a coastal protection measure that protect the inland low lying areas along the East Coast.

The reclaimed land could also be shaped to create more inland waterbodies where heavy rainfall could be channelled into, to prevent floods and double up as freshwater storage areas.

These waterbodies would create more waterfront conditions which also provide opportunities for more beautiful waterfront housing and recreational areas.

Strengthen waste-energy-water nexus

We should pursue integrated infrastructure solutions that combine energy, waste and water as they have the potential to provide benefits across multiple city systems.

For example, while PUB has successfully recycled used water, the process consumes large amounts of energy. A recently announced PUB-National Environment Agency (NEA) project is a good example of how the waste-energy-water loop can be tapped to address the energy issue.

This is a S$9.5 billion project comprising PUB's Tuas Water Reclamation Plant (TWRP) co-located with NEA's Integrated Waste Management Facility (IWMF), which will enable Singapore to reap the benefits of a water-energy-waste nexus while minimising land footprint.

Essentially, electricity generated at IWMF from the incineration of trash will be supplied to TWRP for its operations.

The TWRP will purify used water, transported from the existing Deep Tunnel Sewerage System, into NEWater and industrial-grade water for reuse. At the same time, the de-watered sludge from TWRP will be incinerated at IWMF for electricity production.

Food waste and used water sludge will also be co-digested, through a process called anaerobic digestion, where micro-organisms convert waste into biogas to enhance the overall thermal efficiency and electricity production at IWMF.

Intelligent infrastructure

We should combine engineering and data to enable a more intelligent approach to infrastructure so that we optimise energy generation and distribution, make our buildings smarter and keep traffic flowing. Advances in sensors, controls and software can enable:

a) Increased intelligence and transparency, providing the right information at the right time for informed decisions.

With artificial intelligence we can move beyond normal monitoring of services towards predictive maintenance, where we can anticipate a problem and fix it before the service is affected.

b) Integration: Information can be shared across systems and organisations to eliminate silos and optimise performance.

For example, Smart buildings can take on energy when it is cheap and plentiful, storing it first and then feeding it back to the grid when demand is high, thus optimising the use of energy.

Today, Singapore's infrastructure ecosystem, whilst efficient, may not be fully optimised.

The above linkages between various infrastructure systems suggest that there may be merit to consider the development of a National Infrastructure Plan to ensure that our long-term plans and vision are supported by timely infrastructure that takes a systems approach.

Such a plan would help to further identify specific opportunities to synergise the various urban systems: food, energy, waste, water, transport and greenery, and to close the material and energy cycles to create a circular ecosystem.

Optimal living density needs to be 'appropriate' and involves deliberate and decisive spatial planning and design strategies that continues to make a city highly liveable, says Dr Cheong. TODAY file photo

Deliver well managed and liveable density

With a growing population, living density in Singapore will increase from 11,000 persons per square kilometre to 13,700 persons per square kilometre between now and 2030. However, we need not fear densification if it is done well.

Densification takes place in cities because higher densities enable cities to absorb more people.

Dense cities become engines of economic growth because they offer a larger market size for projects, attract talent for greater innovation and provide the support and connectivity needed for businesses to thrive.

From a sustainability point of view, denser and compact cities also use less energy, are more walkable and help to make public transport options, waste disposal and management services more viable and efficient to operate. However, this is not to say that we densify without thought.

Optimal density needs to be 'appropriate' and involves deliberate and decisive spatial planning and design strategies that continues to make a city highly liveable. The following are some ways that can help to create liveable density.

Constellation of commercial centres to rebalance the urban pattern

To support economic growth, Singapore has developed two distinct economic hubs over time— our Central Business District (CBD) and the manufacturing hub in the west—which house some 70 per cent of our economic activities.

Since Concept Plan 1991, we have adopted a 'constellation' of decentralised alternative affordable spaces for commercial growth outside the city to reduce traffic congestion in the city centre.

As a result, today we have Tampines Regional Centre, which hosts many of the backend functions of banks and new commercial sub-regional hubs like Paya Lebar and Novena, contributing to a better job to home ratio in the various regions.

Nonetheless, there is still high one-way travel demand from across the island towards Central Area and the West Region during peak hours.

To reduce congestion and shorten commute time, URA and LTA are stepping up decentralisation efforts with a newly coined `polycentric' approach.

With more public housing being built in areas like Woodlands, Yishun, Punggol, and in Jurong, there are opportunities to shift more commercial activities and jobs to newer areas.

For example, to the north, we have the upcoming Woodlands Regional Centre, the North Coast Innovation Corridor which will include the Punggol Digital District and the new Singapore Institute of Technology (SIT).

To the west, the new high speed rail terminal at Jurong Lake will catalyse the expansion of the Jurong Lake District Regional Centre into a new major western commercial node.

These commercial nodes will be well-designed, mixed-use environments with amenities and more affordable rents, providing alternative premises for businesses.

The western region will host the new PSA mega port in Tuas, and the Jurong Digital District near Nanyang Technological University (NTU), providing more employment opportunities in these areas.

In turn, more housing will be injected back into the Central Area with new opportunities for development at the southern waterfront, Marina Bay and Marina East. This will improve the job to home ratio, and reduce cross island travel.

Rethink urban mobility

Land use planning must be supported by a good transport system. We have all along adopted a 'transit oriented' approach by encouraging the use of public transport that serve higher density nodes.

Singapore was one of the first cities to put in place policy measures such as the Certificate of Entitlement (COE) car quota scheme and the electronic road pricing in the 1970s to moderate car growth and to manage traffic congestion.

Nonetheless, roads today still take up about 12 per cent of land—almost as much as the 14 per cent of land used for housing. To keep increasing the car population, which would in turn consume more land for roads, is simply not sustainable.

In fact, Singapore's private transport mode share is 34 per cent in 2014, which is higher than Seoul (23 per cent; 2013), Tokyo (12 per cent; 2008) and Hong Kong (12 per cent; 2011), where more people use public transport.

LTA has therefore set a target to improve our public transport mode share during peak periods to 75 per cent by 2030.

We must pursue alternative transportation modes beyond the car. In Singapore, there is now a big push towards a 'car-lite' society. Last year, LTA announced that it will adopt a zero car growth policy.

The idea is to shift increasingly towards 'mobility as a service', rather than having individually owned cars.

LTA is piloting car sharing and AV vehicles to yield greater efficiency and safety so that road space can be reduced. Car parking supply are being tightened, particularly within the city core.

Last year, URA exhibited possible ideas for future neighbourhoods at Bayshore and Holland Plain, and architects have mooted the idea of reducing car parks by 50 per cent in those districts.

A 'car lite policy' will need to be supported by alternative affordable and convenient modes of transport. LTA is investing heavily in rail and doubling the rail network from 178 km to 360 km by 2030.

LTA has also added on a larger fleet of some 1,000 buses. Many kilometres of cycling tracks are being developed to encourage more people to cycle.

In 2017, LTA passed the Active Mobility Bill to allow the use of bicycles and Personal Mobility Devices (PMDs) on public paths. We now have bike sharing too. It is still early days to conclude whether cycling will take off in a big way and whether we can get the cyclists, pedestrian and drivers to co-exist harmoniously. In the meantime, the cycling network will continue to be expanded to improve convenience and connectivity.

To further reduce congestion, there is a need to explore more sustainable urban logistics solutions too.

JTC is looking at incorporating a central distribution centre at Jurong Innovation District (JID) where goods are stored and handled, and a dedicated road network for the delivery of goods to companies.

The government is also looking into an island wide federated parcel locker network to ease the last-mile delivery challenges.

There is likely to be increasing use of unmanned aerial vehicles (UAV). For example, Airbus's Skyways project aims to provide efficient, seamless delivery of small parcels via drones across the National University of Singapore Campus.

Such initiatives require us to consider designing cities that cater to 3D mobility which includes safe pathways and landing for UAVs and regulations to ensure safety.

In fact, NTU's Air Traffic Management Research Institute (ATMRI) is developing a traffic management system for drones called the Traffic Management of Unmanned Aircraft Systems.

Air traffic lanes are designated by using 'virtual fences' to reroute drones around restricted geographical locations, thus enabling hundreds of UAVs to fly efficiently and safely at any one time.

Build a city of greenery and water

Our agencies, such as URA, National Parks Board (NParks), PUB and HDB have done much to achieve a finely balanced urban development, complemented by lush greenery and waterbodies throughout the island.

There are some 360 parks today and more will be built. At a national level, we have safeguarded large swathes of nature reserves right in the heart of the island and national parks such as the Botanic Gardens and Gardens by the Bay within the city centre.

The new Jurong Lake Gardens will be the first national garden within the HDB heartlands and next to the new western region commercial node.

We are constantly creating the 'illusion of space' through innovative 'multiplication' effects. For example, URA successfully created a large linear hill park simply by connecting Mount Faber and Kent Ridge Park with interesting bridges which straddle over roads.

Our park connector network has enabled greater access to cycling and jogging trails, with links to multiple parks and coastal areas.

The rail corridor will soon become another well-loved space for a quick get away from the hustle and bustle of the city.

Imagine the possibility of linking the rail corridor with surrounding attractions with historic areas and parks, with offshoots to interesting neighbourhoods, food havens, nature and biodiversity areas. It would indeed be a creative way to expand our leisure space multi-fold in this small island.

At the building level, we are replacing the greenery lost to developments on the ground through the creation of new land by way of sky terraces and sky gardens. Water elements are weaved into the urban scape using water sensitive urban design comprising bio swales and rain gardens.

By planting the right plants, we are bringing back greater biodiversity and attracting the return of wild life such as otters, hornbills and other birdlife.

Developing a `People City' using excellent design

Successful liveable and distinctive cities are 'people-focused'. They go beyond functionality to build identity, image and a great environmental quality through good design.

We need to develop a pervasive culture of design excellence from macro urban design to the smallest details of a building and city infrastructure.

A well-executed juxtaposition of high and lower blocks can provide both relief and a more interesting and distinctive skyline for the city.

Well-designed high density developments interwoven with landscaped greenery, water bodies and public spaces, conveniently served by facilities can produce a high quality living environment.

Great public spaces encourage community interaction and activities and bring vibrancy to a city. Beyond the design of great public spaces, we should promote effective place-making and programming to encourage greater vibrancy and community interaction.

We have already been successful in generating much activity in areas like Marina Bay and the Civic District. Roping in stakeholders to take ownership of place making activities is essential to sustain such activities.

Good urban design will help to shape a good environment and enable us to plan well for an aging population. We need to embrace universal design, mixed uses and new typologies to enable convenient movement, access to facilities and promote social interaction.

I would also appeal for greater attention to be paid to the quality of design of our public spaces and urban infrastructure.

Increasingly, our urban infrastructure is creeping into our crowded streetscape, and if we are not careful, could mar the visual experience of our city.

Careful attention must be paid to the design of larger urban structures such as the increasing numbers of ventilation buildings and MRT stations and entrances.

There are also miles of overhead ramps, pedestrian bridges, link ways and multiple signages that crop up along a street. We need to bring some order to these as we experience a city largely at the street level.

We can take a leaf out of cities that have lovingly nurtured a design culture that looks at all aspects of public infrastructure.

For example, Bilbao commissioned Norman Foster to build the signature ‘fosteritos’ that are the entrances to all its subway stations. Barcelona has attractive boulevards such as Passeig de St Joan Boulevard, where the scale and design of sidewalks, trees, signages, lamp posts and street furniture are all beautifully coordinated.

Transport can be beautiful if we put some thought into careful design before we build.

As a small integrated city state, Singapore is well poised to harness smart technology and to pilot integrated urban solutions in a big way.

We are in an exciting time where several extensive projects are lined up for development, such as the Jurong commercial nodes and Tuas Mega Port in the west, Punggol Innovation Corridor in the north, the expansion of Changi Airport in the east and the greater southern waterfront development in the south.

With thoughtful people centred planning, strong science and technology and an innovative spirit, Singapore can continue to transform for the better.

Dr Cheong's third IPS-Nathan on Shaping The Future of Heartland Living will take place on April 23.