URBAN SOLUTIONS

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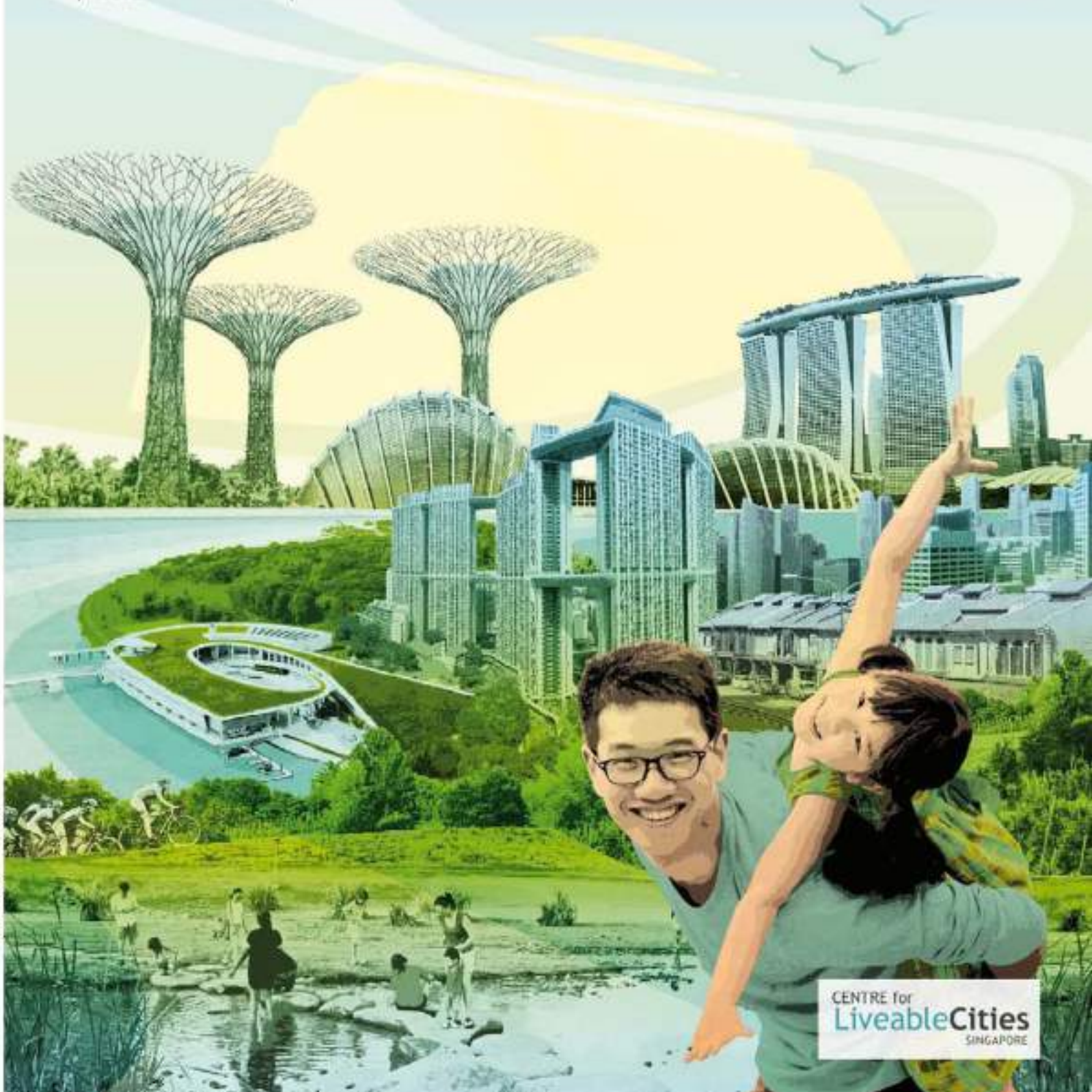
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FROM THE EDITOR

Greetings from the Centre for Liveable Cities, Singapore – and welcome to the inaugural issue of our bi-annual magazine, **URBAN SOLUTIONS**!

The Centre for Liveable Cities, or CLC, works to distil, create and share knowledge on liveable and sustainable cities. As our flagship periodical, **URBAN SOLUTIONS** aims to deliver useful content to city leaders and urban practitioners on how to make their cities more liveable and sustainable. We will feature best practices, relevant research and new ideas from top global practitioners and thought-leaders in urban planning, development and governance. To enrich the magazine, CLC will co-curate some issues with our stakeholders. Our first two issues are joint editorial efforts with Singapore's Urban Redevelopment Authority (URA), to explore the topic of planning for liveable high-density cities.

Features are a signature component of our practitioner-oriented magazine. Here, city leaders share their experiences and best practices with reference to a real project, policy or programme. In this issue, we profile inspiring stories from Brazil, China, Ethiopia and Singapore. Instead of a single initiative, **City Focus** takes a broader look at one city as a whole. Our inaugural city being featured here is New York, also the winner of the Lee Kuan Yew World City Prize 2012.

We are honoured to feature thought-provoking **Essays** by renowned urban design and planning luminaries – Sir Peter Hall (UK), Dr Cheong-Chua Koon Hean (Singapore), Dr Alfonso Vegara and Mark Dwyer (Spain), and Yang Baojun (China). We are likewise delighted to have our inaugural **Interview** with Dr Liu Thai Ker, Singapore's 'Father of Urban Planning'.

Experts and research centres share their works in our **Research & Reports** section, where we have articles by Flemming Borreskov of Realdania, and Jeremy B. Bentham of Shell. CLC is also pleased to present our own research on the CLC Framework for Liveable and Sustainable Cities, which aims to help city leaders consider how they can improve urban liveability and sustainability.

I hope that you will find **URBAN SOLUTIONS** informative, inspiring, and most of all useful in helping you – the leaders and shapers of the world's cities – improve the quality of life and environment for your people, and for future generations to come.

Khoo Teng Chye
Executive Director,
Centre for Liveable Cities

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Hai Phong, VIETNAM
Project area: 1,600 ha

This fourth VSIP development in Vietnam is skillfully master planned for modern urban living. The setting for the new river district in Hai Phong City, the **VSIP Hai Phong's** industrial, business and residential zones will be integrated with the city's arts and cultural precinct, trade & convention centre and cruise terminal.

Nanjing, CHINA
Project area: 1,500 ha

The **Sino-Singapore Nanjing Eco Hi-tech Island** sits on the largest island in the centre of Nanjing and is located 6.5 km from the mainland's new central business district. This urban development is conceived as the destination for talented individuals to meet, learn and live and where information and communication technology companies can innovate amidst an enhanced eco environment.

Sichuan, CHINA
Project area: 1,000 ha

The **Singapore-Sichuan Hi-tech Innovation Park** leverages on the rising influence of China's central-western region. The development seeks to incubate research and design labs and high-tech manufacturing activity in Chengdu's Tianfu New City central business district. It is envisioned to be a place for exciting social and industrial development, talent gathering, exchange and interaction.

INTERVIEW:
Dr Liu Thai Ker

Dr Liu Thai Ker has been the Director of RSP Architects Planners & Engineers since 1992. He is also the Chairman of the Advisory Board of the Centre for Liveable Cities in Singapore since 2008. As an architect-planner and later CEO of the Housing and Development Board (1969–1989) and Chief Planner-cum-CEO of the Urban Redevelopment Authority (1989–1992), Dr Liu was instrumental in the successful implementation of public housing and the formulation of a vision for urban development in Singapore. Dr Liu obtained his Bachelor of Architecture from the University of New South Wales in 1962, and a Master in City Planning from Yale University in 1965. In 1995, he was conferred Doctor of Science honoris cause by the University of New South Wales. His personal interests are in painting and calligraphy. He is married to Gretchen Gustafson, a writer, and has five children.

Through your remarkable career in Singapore's public housing and planning agencies, you have shaped this city's landscapes and lifestyles. In your current role as a consultant, you design cities and advise mayors from around the world. What are other cities most keen to learn from you, and why?

Dr Liu: Visitors to Singapore never fail to notice that our city is green, clean, pollution-free and visually neat. They soon enjoy the fact that our traffic flows and infrastructure works well. Our prosperous economy and the very good public housing developments further win them over. In our HDB estates, amenities for daily needs of the residents are well provided at convenient locations. This helps reduce the need for residents to travel outside their new town and save a great deal of time on the road. Indeed we have managed to create a quality environment, in the last five decades, despite the high density and fast pace of development. This is particularly meaningful to our visitors because most Asian cities experience very high density as well as immense pressure to develop quickly. Given more time, they also like the fact that our citizens are generally civilised and respect traffic rules. And there appear to be no policemen in the streets. I explain to them that we do indeed have policemen but their presence is very low key and quite friendly.

In terms of liveability and sustainability, the first few favourable impressions that our visitors gather, as mentioned earlier, are key contributors to the making of a quality urban environment. To achieve this, there are many other considerations that operate below the surface, unseen and often unknown to most people. For example, comprehensive infrastructure planning, protection of nature and ecologically sensitive areas, and energy conservation strategies and policies. Beyond meeting basic requirements, Singapore has given close attention to biodiversity. In the process of trying to be self-sufficient in drinking water supply, the Active, Beautiful and Clean Waters (ABC Waters) Programme was introduced, to combine function with liveability. Furthermore, our legal system has been highly rated. Our cultural programs are credible. In fact, the city is home to many creative designers, performers and writers.

The lesson, and therefore the message, which I often share is that the liveability, sustainable and unique beauty of a city do not depend on architecture alone. There are many other qualities that can powerfully shape the quality of a city.

Like all cities, Singapore is a work in progress, and it constantly seeks to renew and improve itself. What are the areas where Singapore can learn most from other cities? Can you give some examples that you would like Singapore to learn from?

Dr Liu: I believe we have done very well in laying a solid foundation to create an urban system and provide the fundamental needs of the society. But, for further refinement in the areas of regional character, elegance, dignity and subtlety, there is room for improvement.

What can Singapore learn from other cities? This issue may be dealt with in two parts: the hardware and the software aspects.

On the hardware side, we may learn from other cities on how they make better use of the local vegetation, trees, shrubs, and so on in their landscape. In the urban milieu, we can also learn from some of the cities on how to take advantage of the special climatic conditions to create urban spaces and architecture. For example, being in the sub-tropical climate zone, designers in Brisbane have developed an architecture typology that is uniquely Brisbane. In Singapore we would do well to continue our quest for the kind of architecture that is more tropical and Asian, while at the same time durable and classical in its aesthetic appeal. The quality will elevate our city to stand more firmly among the great cities of the world.

While we have done an excellent job in preserving and conserving the historical buildings and historical districts, I still hope that our government will conserve the last remaining Malay and Chinese *kampong* (village) in Pulau Ubin for the sake of posterity.

On the software side, we need to improve our spoken languages. We have a journey ahead to nurture artists, performers and writers telling our Singapore stories but with universal appeal. We need to help more Singaporeans, especially the next generation citizens, to look at problems and issues with greater intellectual depth and curiosity. A city is not made of bricks and mortar alone. The quality of its people and their achievements are just as important.

You've recently spoken about how you see Value, Science and Art as being at the heart of sustainable urbanisation. Can you explain this to us?

Dr Liu: The 21st century is the century of urbanisation in Asia. If Asian countries are to become urbanised like America, with a similar quality of urban environment, China will have to build the equivalent of three Americas, India five Americas, and Indonesia two Americas. That is assuming that they do their jobs well. If they don't, they may have to build and demolish and therefore build even more than 10 Americas. That will be a serious drain on world resources and may even cause further environmental deterioration of planet earth. For these reasons, I ask myself what are the few most critical factors, which might help Asian countries plan and develop their cities well, with minimum waste and little averse effect on our globe. I can think of three main starting points, i.e. Value, Science and Art.

> **In fact, I like to think that a city is the largest man-made industrial design, like a giant car, a huge washing machine or a mammoth refrigerator. This urban machine must first function extremely effectively and efficiently. It must also be user-friendly, like all industrial design products.**

If good, sound values of urban development can be embraced by top political leaders that will make a great start for urban planning and development. This is easier said than done. The political leaders in Asian cities tend to have a very strong say about how they want the city to be developed. Therefore, it is very important for these leaders to have a good understanding of what is good quality living in cities. In the old days, before the mid-20th century, when cities grew slowly and population sizes were generally quite small, the city elders tended to be people who had lived in cities for decades and even generations. Without being trained as city planners, they instinctively understood the culture of good urban life and therefore were generally able to make sound decisions for the growth of their cities. But in today's Asian cities, because of rapid and massive rural-urban migration, many urban dwellers are first generation rural people. Some of them only live in cities for only a few years, including some political leaders. With the best intentions in the world, they might not be able to grasp in such a short time what makes a good city and therefore may often make unfortunate choices. For example, many of them

tend to believe that sensational architecture is progress. But we know that a mere collection of sensational architecture does not make a good city, especially if the buildings are more grotesque than beautiful. To make a good city, we need to protect as well as develop. We need to build urban systems for infrastructure, roads, parks, commercial centres, etc. We need to consider functionality, liveability, and sustainability as well as beauty.

But our attention should also turn to urban planners themselves. Many experts believe that urban planning is mostly about urban culture. This is only partially true. There is a very serious and challenging aspect of urban planning, which requires a city to function perfectly like a Giant Urban Machine for Living. In fact, I like to think that a city is the largest man-made industrial design, like a giant car, a huge washing machine or a mammoth refrigerator. This urban machine must first function extremely effectively and efficiently. It must also be user-friendly, like all industrial design products. It must be easy for residents to use and

enjoy the facilities. But it is not a simple task to assemble this giant urban machine. To begin with, a planner must know what parts are required for the machine to function perfectly. How big is each of the parts? How many of each type? How should the parts be fitted in relation to one another? To answer these questions, and assemble the parts, requires a great deal of research and experience, as well as a tremendous amount of stamina. No matter how arduous, as planners, we cannot afford to ignore any of these issues if we are committed to producing good master plans that work.

However a city is not just a functional machine or a heap of individual parts. There are aesthetic and cultural components as well. Many city leaders want their city to be unique and impressive. They wrongly believe that these can be achieved through sensational architecture design. I would like to suggest that rather than architecture, the two most powerful ingredients for uniqueness of a city are its:

· Natural environment (such as rivers, hills and wetlands)
· Historical buildings and historical districts

These two ingredients, if well protected, set one city apart from another. With regards to nature, no two rivers, lakes or hills look alike. In the old days, before the onset of globalisation, architecture design depended heavily on using local materials, assembled by local craftsmen to meet the challenges of the local climatic conditions (without access to modern technology) and dictation of local customs. The result – these buildings were very different from one village to another. In short, a city plan should first consider what to conserve in the natural environment and the historical districts. To do so, a city planner needs to have a good aesthetic sense and feeling for the land. In

the process of creating the plan, he/she also needs to have high respect for the terrain of the city. In assembling the different components of the plans, he/she is expected to make every effort to fit them seamlessly into one another. I often urge that a city planner must learn to romance with the land.

Value, Science, Art – these are the three starting points which a planner will need to ponder seriously and work diligently in order to create a good city plan.

There seems an expert consensus that high-density cities are more sustainable than urban sprawl. Yet, many citizens around the world equate high-density living with a lower quality of life. You've stated your belief that high-density cities can be highly liveable. Why do you think this, and what do you think are some of the best examples of highly liveable, high-density environments in the world?

Dr Liu: Although not among the densest cities in the world, Singapore's density is clearly high. Despite that, in terms of the liveability quality, Singapore is ranked among the highest in the world. We have thus demonstrated that a city can have both high density and high liveability. New York City, being the second recipient of the Lee Kuan Yew World City Prize, is another good example. Careful planning coupled with provision of public places and amenities are some of the key considerations for high liveability. There are also techniques required to help a city achieve high liveability. Cities like New York, Chicago and Singapore, whilst having very tall buildings they are moderated by parks and plazas, as well as an interspersal of low or mid-rise buildings. Among them are historical buildings for conservation. I am personally hopeful that given proper skills, we can still make

high-density cities liveable. In the case of Singapore, if our population needs to continue to grow, albeit at a slow pace, we have to face the reality and deal with it skilfully and confidently.

URBAN SOLUTIONS is aimed at mayors from around the world, as well as other urban experts and practitioners. If there is one message you can give to the leaders of the world's cities, what would it be?

Dr Liu: One message is that no matter how backward a city is, as long as its top leaders are committed to improving the city to world standards and learning the sound values of urban development, it is a good start. This needs to be complemented by an enlightened administrative system in which the leaders will focus mainly on important policy decisions, and the planners – assuming they are competent – must be given ample freedom and creative space to carry out their work.

Considering that the amount of urbanisation in the next few decades is going to be immense, it is the sacred duty of these leaders and their planners to plan the city properly, for the sake of collectively building a better world instead of a more urban world that brings diseases and problems to our planet.

By Eduardo Paes

INTEGRATING EMERGENCY RESPONSE MANAGEMENT

FOR A RESILIENT RIO

The Challenge

In 2010, an overnight flash flood hit Rio de Janeiro, resulting in 28 centimetres of rain and 68 deaths. Approximately 15,000 people lost their homes to landslides, and a further 10,000 people were at risk of losing their homes, as the rain continued long after the initial flash flood.

The city's transport system was paralysed, with highways and bridges forced to close and, in certain areas, residents urgently needed to be evacuated. In other cases, people were asked to stay indoors until the storm passed. It was one of the worst natural disasters to hit Rio in recent history.

In part, the catastrophe was unavoidable, but the consequences of the storm might have been less severe had various city agencies had the necessary communication systems in place, in order to respond to the crisis faster and more effectively. At the time, Rio's emergency preparation was lacking. It was a painful lesson but,

as a result, the city is now prepared for almost any eventuality — planned or unplanned.

The Solution

Following the floods, the city's immediate concern was emergency response management. As mayor, I vowed that Rio would never suffer such a tragic disaster again. With less than a year before the next rainy season, the city had to act quickly. Six weeks after the April 2010 storms, the city's planners had the technological and physical blueprint for the Rio Operations Center - an emergency management operations centre that was created in collaboration with IBM.

This was not simply a call centre and dispatch system. The groundbreaking proposal broke down traditional communication barriers between city agencies and built an operations centre where information could be centrally sourced, shared, stored and analysed.

The Rio Operations Center was integrated with IBM's weather

modelling and forecasting tool (called Deep Thunder) that employs fine-grain calculations to predict floods and landslides - and their precise locations - up to 48 hours in advance. These models, integrated with data streams and communications systems from multiple municipal agencies, would allow authorities to prepare a response before a disaster strikes, and emergency teams could be positioned ahead of time in optimal locations.

Before the centre was built, each department operated independently and was hindered by the quantity, quality and relevance of its data. Under the new system, we slashed emergency response times by 30%, which is no small feat in a city as large as Rio.

It took six months to install the core system and, once completed, it proved so effective that the city decided to take it a step further. There was no reason the Rio Operations Center should be limited to emergency management. Using innovative technologies, such as

IBM's analytics software, the city's various authorities realised that they could monitor city systems and predict potential issues before they occurred.

For example, a report of a fire on a major freeway is relevant to firefighters as well as transport departments. While firefighters travel to the scene, transportation authorities can redirect traffic to help minimise congestion. With the operations centre, the city was able to integrate data from all of its departments under a single system. Some people labelled the initiative as being "experimental" due to radical information sharing and the breaking down of departmental boundaries, something that traditional government organisations were – at that time – not used to.

Physically, the Rio Operations Center resembles a "nerve centre" – a giant screen shows maps with weather patterns and specific spots that are vulnerable to floods or landslides. A second section streams video feeds from 850 video cameras that are mostly positioned along major transportation routes around the city. Finally, the most important data available at any given time – the city's 'vital signs' – are highlighted in a third sector, which looks similar to a dashboard.

In order to get all agencies on board, the city's planners asked all 31 municipal departments to appoint one leader and staff members to work on location. They also appointed a Chief Operations Officer to oversee the entire facility.

The Outcome

An interesting thing happened when employees from every municipal department were forced to work together under one roof. Those who might have otherwise been reluctant to cooperate with people outside of their organisation began collaborating with others naturally.

While the system does indeed work, the city has not become complacent. In fact, the city is constantly working to improve it. Recently, various algorithms were tested on historical storms and flooding to see whether the new software accurately predicted problematic areas. In cases where the algorithms were off, adjustments and modifications were made to improve their accuracy.

In November 2011, the city also conducted simulations of landslides and flood emergencies, which involved more than 100 city managers, to test technologies and coordination procedures that the city had put in place for emergency response.

In the event that the same flash flood that occurred two years ago were to hit Rio today, the city could not guarantee it would avoid damage. It could, however, guarantee its response to be quicker, more effective and more efficient than it ever was before.

Eduardo Paes started his political career as the head of the Barra da Tijuca and Jacarepaguá districts in Rio de Janeiro. He then became a city councilman, President of the City Council, a congressman, the Municipal Secretary for Environment and the State Government's Secretary for Sports and Tourism in 2007. In 2008, Eduardo Paes was elected Mayor of Rio de Janeiro. He has since created numerous urban initiatives that include Porto Maravilha (revitalisation of the port area), Morar Carioca (urbanisation of all the favelas), UPP Social (development of social programmes in pacified favelas), and the Rio Operations Center (a nerve centre that monitors all municipal logistics).

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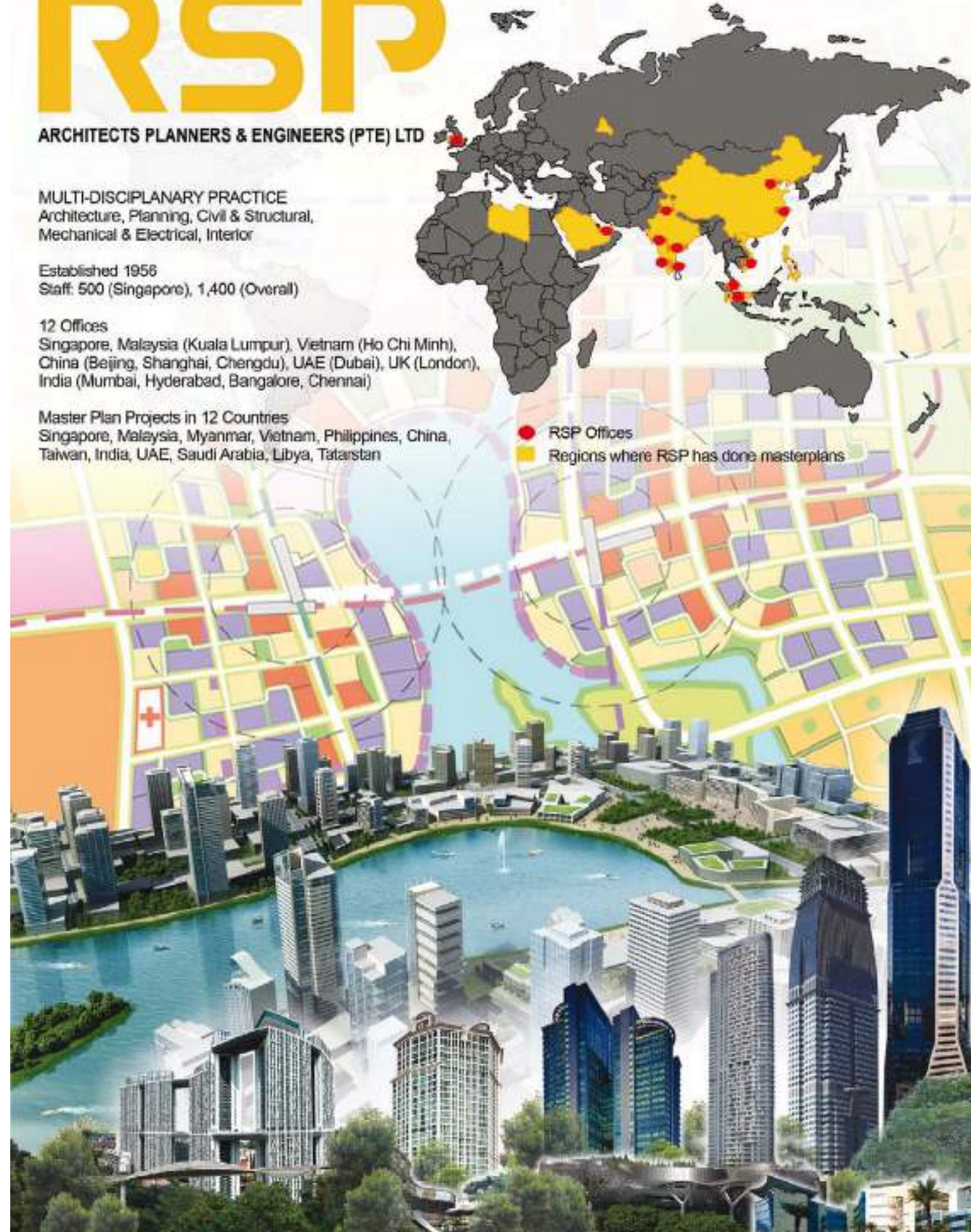
By Tan Nguan Sen

REVITALISING SINGAPORE'S URBAN WATERSCAPES:

ACTIVE, BEAUTIFUL, CLEAN WATERS PROGRAMME

The Challenge

Singapore is a densely populated, island city-state with over five million people living in an area of only 710 square kilometres. Although it receives ample rain, its small catchment area means there is insufficient ground space to collect and store enough water for its needs. In addition, the island does not have extensive aquifers or groundwater. Ensuring water sustainability is, hence, a strategic national challenge.

During the 1960s and 1970s, Singapore faced multiple problems associated with rapid urbanisation. These included polluted rivers, water shortages and widespread flooding. Yet today, it is capable of producing enough water to satisfy the requirements of its population and industries. In just four decades, Singapore has overcome its water challenges and turned its vulnerability into a strategic asset.

Singapore has 32 major rivers, 17 reservoirs, and more than 7,000 kilometres of drains and canals. The Blue Map of Singapore on page 15 shows this pervasive network of waterways and water bodies. Moving beyond a source of water supply, the PUB, Singapore's national water agency – saw the potential of using these 'blue spaces' to encourage people to create more interaction between people and water.

The Solution

In 2006, PUB launched the Active, Beautiful, Clean Waters (ABC Waters) Programme with the aim of transforming Singapore's network of functional but utilitarian drains, canals and reservoirs into vibrant and aesthetically pleasing streams, lakes and rivers with lush landscaped banks. They are also integrated into surrounding residential developments, where residents can enjoy activities close to the water.

The ABC Waters Programme is not only an asset in improving water quality, but also an urban revitalisation tool that improves accessibility, aesthetics and recreational potential. It has created new community spaces and opportunities for people to enjoy and appreciate water bodies and, in so doing, bond with water. The integration of the ABC Waters sites with park connectors also

helps create a sustainable urban environment.

PUB adopted a three-pronged approach for the project's implementation. This entailed the development of a master plan, sustained engagement of the community, and efforts in encouraging the public and private sector to adopt the ABC Waters concept.

Strategy One: Developing the ABC Waters Master Plan

PUB initiated three demonstration projects at Bedok Reservoir, MacRitchie Reservoir and a stretch of the Kallang River at Kolam Ayer. With the experience gained, a master plan was developed to identify over 100 potential projects across the island to be implemented over the next 10 to 15 years.

The map of Singapore was divided into three watersheds – Central, Eastern, and Western – each with its own themes and projects. A team of multi-disciplinary consultants was then engaged for each watershed, working together with other government agencies, including the Urban Redevelopment Authority (URA), the Housing and Development Board (HDB), JTC Corporation and the National Parks Board (NParks). With this integrated approach, ideas and resources could be pooled in order to synergise the infrastructure planning.

Strategy Two: Engaging the Community

From the outset, PUB recognised the importance of actively engaging the community. Thus, a publicity campaign was launched in 2007. It started with an exhibition officiated by Singapore's Prime Minister, where the public were invited to learn more about the programme and what it set out to achieve. The campaign got residents excited about the projects near their homes and was well received.

PUB also carried out extensive briefings, consultations and road shows involving grassroots leaders, educational institutions, and non-governmental organisations. Such sessions helped refine the projects based on users' feedback. Site visits held during the project's construction stage kept the stakeholders regularly updated and helped get their buy-in.

Through PUB's Our Waters Programme, members from the public, people and private sectors can 'adopt' waterways or reservoirs and organise community events or develop sustainable projects at these sites. As of March 2012, there are 158 corporations, schools and organisations that have adopted various waterways and reservoirs.

Strategy Three: Encouraging Adoption Of ABC Waters Concept by the Public And Private Sectors

The public and private sectors are encouraged to embrace the ABC Waters concept and incorporate its design features – such as bioretention swales, rain gardens and wetlands – in their developments. Such environmentally sustainable features minimise the hydrological and pollution impact of urbanised catchments and safeguard water quality. PUB has compiled information on these features into the ABC Waters Design Guidelines handbook (launched in 2009) as reference material for industry professionals to incorporate into their development projects.

The ABC Waters Certification scheme, launched in 2010, recognises organisations that embrace the ABC Waters concept and holistically incorporate its design features in their developments. Additionally, the BCA (Singapore's Building and Construction Authority) Green Mark Scheme – a benchmarking scheme that incorporates

internationally recognised best practices in environmental design and performance – acknowledges the inclusion of such design features.

PUB also taps into the experience of top local architects, engineers and developers, which comprise the ABC Waters Review Panel. They review the master plan, and the design of strategic projects.

The Outcome

The ABC Waters programme has provided a framework for an integrated planning process, where multi-disciplinary teams from various government agencies and stakeholder groups collaborate creatively. The results are seen in key projects such as the Sengkang Floating Wetland and the Kallang River at Bishan-Ang Mo Kio Park.

The latter is a flagship ABC Waters project, and a collaboration with NParks. Designed based on a flood plain concept, it entailed the transformation of a 2.7 kilometre stretch of Kallang River that ran in a canal along the edge of the park into a lush river meandering through the park. Bishan-Ang Mo Kio Park was initially identified as a 'people's park', and the design facilitates that. When the water level in the river is low, users can

get closer to the water and enjoy recreational activities along the banks. Yet, upon heavy rain, the parkland next to the river doubles-up as a conveyance channel, carrying excess water downstream. The concrete canal walls were naturalised using bio-engineering techniques. Plants and bedding materials were also used to stabilise the banks, and to create a natural habitat for native plants and animals.

Opened in March 2012, this project has demonstrated that careful planning and innovative design can transform concrete waterways into socially rejuvenating urban waterscapes, characterised by a thriving ecosystem that is enriched with biodiversity.

The success of the first phase of the ABC Waters Programme was made possible with strong support from PUB's 3P (People, Public, Private) partners. Since its launch in 2006, 18 projects have been completed by PUB with four more currently being implemented; 14 projects have been completed by other public agencies and private developers with another 17 are in the pipeline. For two consecutive years, World Water Day celebrations have been held concurrently across the island,

with more than 25,000 people gathering at 15 ABC Waters sites.

Realising the programme's full potential may take decades, but the success thus far has allowed PUB to embark on a second phase. This will see the creation of yet more recreational hotspots in order to educate people on the importance of keeping Singapore's waters clean; the notion behind which stems from the belief that long-term sustainability can only be achieved when people become stewards of the environment.

Tan Nguan Sen is the Director of Catchment and Waterways Department at PUB, Singapore's national water agency. He has extensive experience in planning and designing drainage and used water infrastructure, as well as in the construction, operation and management of drainage and water reclamation facilities. Prior to his current appointment, he was involved in formulating key policies and charting the master plans for used water and NEWater in the Planning and Policy Department.

Mr Tan graduated with an engineering degree from Munich Fachhochschule, Germany. He went on to pursue a post-graduate diploma in Hydrological Engineering from the International Institute for Hydraulic and Environmental Engineering in Delft, the Netherlands. Subsequently, he obtained a Master of Science in Management of Technology from the National University of Singapore.

By Abebaw Alemayehu and Wendy S. Ayres

STEPPING STONES TO BETTER CITIES :

URBAN GOVERNANCE REFORM AND CAPACITY BUILDING IN ETHIOPIA

The Challenge

Ethiopia's urban areas are among the fastest growing in Africa, with populations rising at about 4% each year. By 2020, cities are projected to be home to 20% of Ethiopia's population. Moreover, the urban economy is a major driver of growth, with urban areas now accounting for over 55% of Gross Domestic Product (GDP). Approximately 60% of this growth has been linked in recent years to the urban economy, and urban areas will continue to drive Ethiopia's economic prosperity for the foreseeable future.

However, urban areas in Ethiopia have only had functioning governments since the year 2000, when proclamations to establish urban local governments were first issued. Combined with a commitment to fiscal decentralisation, the proclamations were intended to give the authorities more direct and transparent control over public spending. The objective was to create urban local governments that ensure public participation in making choices, and enhance urban service delivery.

The principal challenge associated with this was how best to help urban local governments develop the skills and financial resources they need to deliver infrastructure and services to residents, effectively and efficiently. An additional challenge was how to create jobs for the significant proportion of urban residents who were unemployed.

The Solution

The solution involved a sequence of initiatives. The first step in the strategy was to build capacity as part of the Ethiopian government's comprehensive National Capacity Building Program, which was launched in 2001. This led to the Capacity Building for Decentralized Service Delivery Project, which became effective in 2003, and then to the Public Sector Capacity Building Program that started in 2004.

Both of these programmes were supported by the World Bank, and they provided conditional grants to finance capacity building and systematic reforms. Among other things, these projects supported the establishment of an accredited master's degree program in urban management at the Ethiopian Civil Service College.

By the end of 2011, more than 1,700 students had been awarded degrees. Upon graduation, students are required to serve for a minimum of five years in a local government administration. Even after this probationary period, the majority of graduates still serve as planning specialists in a city, regional or federal government department.

The second step was to provide grants to selected urban local governments. The size of these grants varied. They were subject to the administration's performance in the areas of financial management, participatory planning, investment, maintenance of infrastructure, and transparency and accountability of operations. The grants provided urban local governments with resources to enable them to apply their learning, and provided access to other resources, subject to the achievement of key performance indicators.

For approximately five years, city governments also have access to capacity building support and expertise on a grant basis, which was designed to help them strengthen their skills. Following this, each local administration is expected to have sufficient capacity to manage their finances and operations.

Currently, the World Bank is financing this Urban Local Government Development Program (ULGDP) with a US$300 million credit facility.

The Outcome

The results of this project are impressive. Each performance-based grant has had a transformative effect on the 19 Ethiopian cities participating in the programme. All the cities involved, have made significant improvements in their planning, revenue mobilisation, asset management, budgeting, financial management, investment planning, procurement, and project execution, as shown in the results of their annual performance assessments.

Public participation in all cities has grown considerably, starting with

planning. In nearly all cities, the number of citizens participating in planning forums has more than doubled since the start of the project. Previously, cities did not systematically consult citizens to determine planning priorities.

Financial management and mobilisation have improved, due to the introduction of computerised systems that generate financial reports and examine the use of government funds. Cities have significantly increased their revenues by delegating the task of revenue collection to sub-cities. Informal businesses have also been brought on to the nation's tax rolls. In addition, each city has increased tariffs and fees for city services, and raised resident awareness of the importance of paying taxes.

All the cities involved in this project are steadily enhancing their dissemination of key information regarding city functioning to the public. All of them are using multiple channels, including notice boards, newspapers, radio, public events, and – in some cities– the Internet. Many cities now provide comprehensive data on approved capital investment plans, budgets, budget execution, project physical progress, bid evaluations, and contract awards. Councils are also discussing internal and external audit reports and the ULGDP quarterly progress reports.

Arguably of most significance, cities are effectively implementing capital-investment plans, enhancing infrastructure and creating much-needed jobs. They are effectively utilising their budgets for infrastructure investments.

Notably, the funding has been used for cobblestone streets and drainage systems, which are becoming a ULGDP trademark. As a result of the cobblestone works, mobility for residents has increased, flooding has diminished, property values are rising, small

enterprises are opening, and investment in private homes is rising. These changes are transforming city centres into lively and welcoming places to live and work in.

The construction of cobblestone streets has had several other benefits. It has created many new jobs for city residents, with a substantial proportion of these having been undertaken by women, young people, disabled individuals and the previously unemployed. The results have greatly improved their lives.

Many cobblestone workers have now formed micro and small enterprises (MSEs). This enables them to bid for and win contracts for other infrastructure projects, which are essential for these MSEs to become sustainable enterprises. Cobblestone construction also utilises local materials, further contributing to the local economy and reducing costs.

By the end of June 2011, approximately 95,000 people were employed in cobblestone and other infrastructure work that is financed by the ULGDP. Of these workers, 65% are male and 35% female. In fact, citizens appreciate the cobblestone roads, bridges, and drainage systems so much, that they are now contributing their own funds to construct more.

The ULGDP has helped 19 cities across Ethiopia provide better urban governance, infrastructure and public services to over 2.8 million people. With over 42% of the nation's urban population now enjoying the many benefits brought about by the programme, this success has prompted the World Bank to award additional ULGDP grants to a further 18 Ethiopian cities by 2013. Given the economic, social and environmental successes of this programme, it may be an interesting model to other developing nations, in order to boost urban and national

development. This programme has been an effective platform upon which Ethiopia's cities can be transformed from third world urban settlements to vibrant cities of the future.

Abebaw Alemayehu has more than 12 years of World Bank operational experience, including task management in urban and local government, and human development sectors within Africa. Currently, he is task managing the flagship urban programme of the region: Ethiopia's Urban Local Government Development Project. Recently, he prepared additional financing for the programme, doubling its size from US$208 million to US$416 million, in record time and within budget. The lessons of the Ethiopia Local Government Development Project have informed the design of the urban projects in Kenya and in Ghana. He is an economist by training with a postgraduate degree from the UK with further training in the United States and Poland.

Wendy S. Ayres is an economist and has been with the World Bank since 1990. She has been based in Nairobi since 2003. Wendy has worked on a wide range of projects for the World Bank around the world, including Eastern and Central Europe, Asia, South America, and Africa. She is a member of the World Bank's urban team. In addition to the Ethiopia Local Government Development Project, Wendy is currently working on the Nairobi Metropolitan Services Improvement Project, the Kenya Informal Settlements Improvement Program, and the Kenya Municipal Program. She holds graduate degrees in economics and anthropology from Columbia University, New York.

By Ong Beng Lee

TIANJIN ECO-CITY

SETTING NEW BENCHMARKS

The Challenge

Rapid urbanisation has placed immense pressure on the environment, amenities, and resources of cities around the world. It also generates pollution, including greenhouse gas emissions that contribute to climate change. The United Nations Framework Convention for Climate Change (UNFCCC) has declared the collective global effort to keep greenhouse gases at a safe level "grossly insufficient" so far.

China, the world's most populated country, second largest economy, and largest carbon emitter, is at the forefront of rapid urbanisation. Fortunately, the Chinese government understands that, if not properly managed, the rapid expansion of China's megacities will strain its energy, water and land resources and pollute its air, soil and water. It will also increase competition for housing and jobs and lower the quality of life of the people.

China is seeking to develop its urban space sustainably. However, there is no international standard or industry benchmark for sustainable development that China should rely on. To demonstrate their commitment to do their part to strengthen environmental protection and energy conservation, the governments of Singapore and China decided to jointly embark on a project to create a model for sustainable development.

The Solution

The idea for the Sino-Singapore Tianjin Eco-city was conceived by the leaders of China and Singapore in 2007. Tianjin Eco-city aims to provide a model for sustainable development for other cities in China and elsewhere, amidst global concerns about the effects of urbanisation on climate change.

It is the second joint project between the Chinese and Singaporean governments. The first was the acclaimed Suzhou Industrial Park. Built in 1992, it is characterised by state-of-the-art business facilities, modern housing, new universities, schools, and other public amenities.

In Tianjin Eco-city, the two governments have moved beyond industrial park planning to develop 30 square kilometres of wasteland into an economically and socially vibrant, environmentally friendly, and resource-efficient city. Through the project, the Singapore government undertakes to share with the Chinese government its expertise and experience in areas like urban planning, environmental protection, resource conservation, water and waste management and sustainable development, as well as policies and programmes that engender social harmony. Through these engagements with the Chinese government, the Singapore government hopes to learn from them in areas where China is more advanced than Singapore as well. Construction of the Eco-city commenced in September 2008 and, when finished in 2020, it will house an estimated 350,000 residents.

In choosing the city's location, the Chinese government set two criteria. Firstly, the Eco-city should

Legend:
- Residential Type I
- Residential Type II
- Administrative Office
- Commercial
- Cultural, Recreational
- Medical
- Institutional, R&D (University)
- Industrial Type I (Business Park)
- Storage/ Warehouse
- City Infrastructure
- Mixed Use
- Park & Green Space
- Expressway
- Rail
- Main Roads
- City Rail Line
- Lightrail Station
- Waterbodies
- Planning Boundary

细胞 Cell
-Basic Community

邻里 Neighbourhood
- Residential Community

片区 District
- Integrated Site Planning

be developed on non-arable land. Secondly, it should be located in an area with limited water supply. The site was selected after a thorough study by both Chinese and Singaporean experts, and is located 40 kilometres from the Tianjin city centre.

Water has been the Achilles' heel of Chinese urban development as, without adequate water supply, land becomes unliveable and unworkable. Of note, North China is particularly vulnerable to water resource constraints. This prompted the several decade-long South-North Water Transfer Project, which transfers excess water from China's southern heartlands to the urbanised Northeast, including Tianjin. However, even supplies from

this source will be put under intense strain if urbanisation in Northeast China continues unabated.

Tianjin Eco-city sits on non-arable, salt-alkaline land in an area characterised by heavily polluted water bodies. This was due to surrounding factories discharging wastewater and other toxins into the water table. Following an extensive cleaning operation, a pond that was once heavily polluted will soon become suitable for recreation. The Eco-city is also using water more efficiently by means of novel initiatives, which include rainwater harvesting, wastewater recycling and, when residents have moved in, encouraging water conservation.

The Eco-city is transforming the area from wasteland into a thriving and

liveable city, where ecological rehabilitation will be delicately balanced with urban development. The project pays close attention to social and economic development, and environmental protection. Once complete, one-fifth of the city's housing units will be in the form of subsidised public housing, in order to meet the needs of lower income households. Public green spaces, as well as free recreational and sports facilities, will be within 500 metres of all public housing. This will help to forge a more inclusive community.

Buildings will be built high-rise and of high density to optimise land use. The city's plans have a unique cellular layout, where several cells constitute a neighbourhood, and a few neighbourhoods constitute a district. Amenities are planned at the cell and neighbourhood levels so that residents' needs can be met, while minimising the need to commute. Furthermore, jobs in business parks will be within easy reach of residential areas. A light rail transit system, complemented by a modern tram system, will be built in order to meet the transportation needs of residents.

The city's economic hub will generate jobs for its residents, draw talent, and inject vibrancy into the city. To date, it has attracted over RMB50 billion (US$8 billion) in investment. Despite the city enjoying the full support of the Chinese and Singaporean governments, it is intended to be a replicable, scalable and practical model for other cities to emulate, characterised by financial self-sufficiency and commercial viability from the standpoint of investors. As such, the technologies used in the development and operations of the city will be both affordable and suitable for replication elsewhere.

The Outcome
The Eco-city has made progress since construction began four years ago. The project is being tackled in stages, with the first of these near completion. Social amenities, such as schools, healthcare facilities

Huifeng Brook Park

National Animation Centre Park

Wetlands Park at Huifeng Brook

Yongdingzhou Park

❶ **pg 21: Master plan of Tianjin Eco-city.**
Image courtesy of URA, Singapore.

❷ **pg 22, above: Tianjin Eco-city has a cellular layout, where several cells constitute a neighbourhood, and a few neighbourhoods constitute a district.**
Image courtesy of URA, Singapore.

❸ **pg 22, below: Completion of the first parks in the Eco-city.**
Photo courtesy of the Eco-city Project Office/MND, Singapore.

❹ **pg 23, above: The recently completed National Animation Centre in the Eco-city.**
Photo courtesy of the Eco-city Project Office/MND, Singapore.

❺ **pg 23, below: The Tianjin Eco-city utilises renewable energy through solar photovoltaics, solar water heating, ground source heat pumps and wind turbines, thus allowing the city to reduce reliance on fossil fuels. The target is to achieve 20% renewable energy utilisation in the Eco-city by 2020.**
Photos courtesy of SSTEC.

and neighbourhood centres will commence operations soon. Several companies located in the Eco-city have already begun operations, and residents have started moving into their homes.

However, it is the project's ambitious environmental, social and economic goals that really set this city apart. The city's urban planners have introduced a set of 22 quantitative key performance indicators (KPIs). These include developing 100% green buildings that will better conserve energy; 20% renewable energy utilisation to reduce reliance on fossil fuels and tap clean energy like solar, wind and geothermal energy; 90% of all internal travel to be via public transport or non-motorised transport; and at least 50% of employable residents are to be employed within the Eco-city to minimise the need to commute.

Other KPIs include maintaining low carbon emissions per capita GDP, ensuring high recycling rates, and potable water from the tap – a rarity in China.

The Tianjin Eco-city is approximately eight years from completion yet people have started citing it as a role model for sustainable development that other cities in China – and the rest of the world – could emulate. The Eco-city was not planned as an

experimental showpiece. Instead, it is a carefully planned and well-executed project, which hopes to change the way urban planners, from around the globe, design and realise the cities of tomorrow.

Ong Beng Lee is the Senior Director of the Eco-city Project Office (ECPO) in the Ministry of National Development, which is the lead agency for the Tianjin Eco-city project on the Singapore side. ECPO works closely with the Chinese authorities, other Singapore agencies involved in the project and the joint venture company to conceptualise strategies and plans for the Eco-city and to oversee its implementation. Mr Ong has been with ECPO since September 2007. A member of the Singapore Administrative Service, he has previously served in other ministries such as the Ministries of Trade & Industry, Home Affairs and Defence.

NEW YORK CITY

The Lee Kuan Yew World City Prize 2012 was awarded to the Mayor of the City of New York, Michael R. Bloomberg, and the Departments of Transportation, City Planning, and Parks and Recreation, for New York City's remarkable transformation over the last decade. Co-organised by Singapore's Urban Redevelopment Authority and the Centre for Liveable Cities, the biennial award honours outstanding contributions towards the creation of vibrant, liveable and sustainable urban communities around the world.

On 21 March 2012, Mayor Bloomberg delivered the Lee Kuan Yew World City Prize 2012 Laureate Lecture at Singapore's historic Raffles Hotel. In his opening comments, he noted the similarities between New York and Singapore as "crossroads of commerce and homes to many cultures." He added that both cities were "energetic, restless, and forward-looking, constantly in motion, and constantly rebuilding themselves." Mayor Bloomberg commended Singapore's strong commitment to sustainability, which he credited to the leadership of former Prime Minister Lee Kuan Yew, after whom the Prize is named. The following is extracted from a transcript of his lecture.

Long-term planning is vital in New York City, and in other cities, too. Because with more than half the world's people now living in cities and with three-fourths of the people on Earth expected to be city dwellers by mid-century, cities around the globe, including New York, must confront all the effects of this urban growth: in transportation, housing, public health, public safety, education, and in so many other areas.

We also must work to enhance what gives city life its zest. Attractive public parks. Innovative public plazas. Exciting public art. By doing so, we can, as we've demonstrated in New York, reclaim outdated and derelict infrastructure elements for recreational use. Such projects can also be catalysts for private sector investment, creating jobs and producing greater prosperity for all our people.

So let me turn briefly to each of the three 'demonstration projects' that I think very rightly caught the attention of the judges in this year's Lee Kuan Yew World City Prize competition because of the way that they are accomplishing these goals.

Brooklyn Bridge Park

The first is Brooklyn Bridge Park. New York, as you may know, is a city of five major sub-districts, or boroughs – and with some 2.5 million people, Brooklyn is the most heavily populated of our boroughs. In fact, if it were a separate city – which it was until 1898 – it would be the fourth-biggest city in the United States.

Brooklyn Bridge Park, the first portions of which opened two years ago, is one of the most significant new parks to be developed in Brooklyn in some 140 years. Just as importantly, it's one of the most innovative parks created in any city in recent years. Here's what I mean by saying that: traditionally, city parks have attempted to remove park-goers from the hustle and bustle of urban life. Brooklyn Bridge Park does something radically different.

It brings park users right to the edge of one of the greatest, busiest harbours in the world – framed by Manhattan's dramatic skyline and by the classic elegance of the world-famous Brooklyn Bridge itself. It

gives them a front row seat to take it all in – as well as a wide variety of ways to enjoy themselves at the harbour's edge. And it's doing that by creatively reusing what had become relics of Brooklyn's maritime past: Six abandoned piers along nearly a mile and a half of the borough's East River shore. Once they were part of a thriving working waterfront. But a cargo ship hasn't docked at them in more than a quarter-century.

I could easily spend the rest of my time today describing all the striking and subtle ways that the design of the park accentuates this theme of adaptive reuse: The way it captures storm water to irrigate its landscape, for example, or the way materials found on-site were recycled for use in the park. Let me just summarise by saying that Brooklyn Bridge Park – the rest of which will be built out over the next few years – succeeds spectacularly in realising a new vision of what a park in an intensely urban setting can be.

The High Line

The same can be said, enthusiastically, about the second project for which we have been awarded the Lee Kuan Yew World City Prize: The High Line. It was an elevated railway running for about a mile and a half along Manhattan's West Side. Once, it served warehouses and industries in this area, which is still referred to as the 'meatpacking district' – even though today, far more painters and software engineers work there than butchers do. Like the piers we just described on the Brooklyn waterfront, however, the High Line hasn't been a working rail line since 1980.

After decades of disuse, the opinion of many was that the High Line was an eyesore that was impeding the area's redevelopment, and had to

be torn down – the sooner the better. Incredibly, when our Administration took office in 2002, it was just a single court decision away from demolition.

Thankfully, a different vision for the future of the High Line prevailed: And through a combination of private activism and funding, and public investment and zoning action, the High Line has now been re-born as New York's first aerial park.

To quote the architecture critic Paul Goldberger: "Walking on the High Line is unlike any other experience in New York. You float about 25 feet above the ground, at once connected to street life and far away from it." Like the Brooklyn Bridge Park, the High Line plunges visitors into the very heart of a dense urban environment. Like Brooklyn Bridge Park, it also reclaims an artefact of the city's recent industrial past, and reinvents it for the 21st century.

None of this would have been possible without the ingenuity of a rezoning that gave property owners under the High Line value for their land. It convinced them that, far from being a blight, a re-designed High Line could become the organizing principle of a new neighbourhood. And that has, in turn catalysed, some US$2 billion in private sector investment, transforming this neighbourhood into one of the hottest stretches of real estate in the entire city.

Re-purposing the Public Right of Way

The third of the three projects that has earned New York the World City Prize involves 're-purposing the public right of way': In other words, our new approach to using much of our 10,000 kilometres of streets and roadways. It's based on our Administration's strong commitment to dramatically shrinking the city's carbon footprint, to clearing our

air of the harmful pollutants produced by auto exhaust and also to encouraging a safer and more vibrant street life.

For those reasons, we've begun re-designing roadways to provide greater space and safety to travellers who aren't in cars: specifically, to cyclists and to pedestrians. Bicycling has become increasingly popular in New York. In fact, the number of New Yorkers who bicycle to work and school has doubled since 2007, and quadrupled in the past 10 years.

We expect the number of cyclists on our streets to continue growing – in part because later this year, we'll inaugurate the largest 'bike-sharing' program in the Americas. To increase safety for cyclists, since 2007 we've installed more than 430 kilometres of bike lanes in our city. We have, for example, established the first "protected" bike lanes in the United States. They move cyclists out of harm's way, putting them between street curbs and a new parking lane for cars. And because some auto lanes were narrowed in the process, drivers are more cautious, increasing traffic safety for everyone.

We're also reclaiming more public right of way for pedestrians. The most celebrated example is our famous Times Square, which, on average, more than 365,000 people use every day. Traditionally, pedestrians only had about 11% of the available public space even though they comprised 86% of the traffic. This created an unbearable crush on the sidewalks – and also a big spill-over of pedestrians into some of the city's busiest streets. And that contributed to a level of traffic injuries and fatalities more than 50% greater than on nearby streets and avenues.

So three years ago, we took the somewhat controversial step of

closing the major roadway through Times Square – our Broadway – to auto traffic. The results: traffic in the entire area now moves more smoothly. Pedestrians, who now have more than 41% of available public space in Times Square, are far safer. And there's also now an exciting new public space where only congestion and chaos existed before – a big plus for everyone. That includes economic benefits – because the new Times Square plaza, like the High Line, has greatly increased property values. In fact, since 2009, rents for street-level stores along the plaza have actually doubled – despite the effects of the national recession – and Times Square was recently named one of the top ten retail locations in the world. And Times Square is only the tip of the iceberg. We have 50 new neighbourhood plazas in development throughout the five boroughs that will transform underused local streets into vibrant public spaces.

PlaNYC

All three of these projects are elements in our far-reaching *PlaNYC* agenda for a greener, greater New York City. Implementing that agenda also includes everything from developing thousands of new apartments, as well as new parks, on formerly industrial sites on the city's 520 miles of waterfront, some of it complete and some of it still to come.

It includes continuing to improve the quality of our waterways – already cleaner than they've been in a century so that they become a more inviting resource for recreation, and also a home for the wildlife that reminds us that as humans, we share this environment with other living things.

We're making New York an even more public transit-oriented city than we already are, by making our city bus system faster and

more efficient and along several corridors, showing how streets can safely and harmoniously accommodate buses, bikes, cars, and pedestrians.

We've also funded from the City's own treasury the first major extension in decades to New York's famous subway system: a project that will transform the last major undeveloped stretch of Manhattan into the largest new transit-oriented business and residential development in the United States. It will accomplish for this district what the extension of London's underground did for the now bustling Canary Wharf area.

We've also initiated more new public spaces like those I've described today, projects that not only create a more environmentally sustainable New York, but that also make our city more liveable, more attractive, more exciting, and more economically competitive.

All these cutting-edge projects add to New York City's reputation for creativity and innovation. They make us a place where people want to come; especially people who are creative and innovative themselves. Talented people want

to live in the cities that not only give them the greatest opportunity, but that also offer the best quality of life.

Earlier this month, the Economist Intelligence Unit published an exhaustive study on 'global city competitiveness.' It named New York City Number One in the world – just narrowly ahead of London and then Singapore, let me add. The talent of our people, the study said, is what gives us our competitive edge. The projects like the ones you've honoured us for today as well as the ones like it that I've given you a brief glimpse of just now bring talented people to New York, and convince them to stay.

❶ **pg 24-25: People enjoying the vibrant public plaza space at Times Square.**
Photo courtesy of the Department of Transportation, the City of New York.
❷ **pg 26: Located at the harbour's edge, Brooklyn Bridge Park overlooks the Manhattan skyline and the famous Brooklyn Bridge itself.**
Photo courtesy of URA, Singapore.
❸ **pg 28: Originally a disused railway, the High Line has been transformed into an aerial park that runs through the heart of a dense urban environment in Manhattan's West Side.**
Photo by Centre for Liveable Cities.

URBAN DEVELOPMENT IN SAUDI ARABIAN CITIES

Until the 1930s, Saudi Arabia was best known for two things – its desert landscape and housing two of Islam's holiest sites – Makkah and Medinah.

Fast-forward to today and the transformation has been spectacular. In 1938 oil was discovered and, as the industry matured, state revenues quickly began to rise. The economy modernised and the country grew into what we see today – the world's leading producer of oil with a GDP of $24,000 per capita and a burgeoning population.

However, rapid population growth, depletion of water resources, and an economy dependent on petroleum are all ongoing governmental concerns, which have been the catalyst for mass urban development programmes.

Around 86 per cent of today's estimated 26 million population reside in Saudi Arabia's cities. Therefore, sustainability, creating jobs, housing and improved infrastructure are all high on the agenda for the future of Saudi Arabia.

The Crown Prince's Commitment To Urban Development
The work of HRH Prince Mansour Bin Mitib Bin Abdulaziz, Minister of Municipal & Rural Affairs (MOMRA), has been key to driving successful infrastructure development to aid the Kingdom on its path of expansion. Development plans in each of Saudi Arabia's 13 administrative regions fall under his guidance and he has been instrumental in

implementing the ninth Saudi development plan, which has allocated US$385 billion to develop the infrastructure in major cities between the year 2010 and 2014.

Plans at city level also adhere to King Abdullah's overall strategy of economic diversification. This involves, creating more jobs for Saudi's ever-growing young workforce (the average age is 26), encouraging growth in the private sector and attracting foreign investment.

New Economic Cities
One of the leading examples of the Saudi Arabian government's determination to revitalising the economy and developing the country is the construction of six new economic cities.

King Abdullah and the Saudi Arabian General Investment Authority (SAIGA) announced the project in 2005. Four of the six developments are now fully planned and under construction. More than $60 billion is being ploughed into four of the cities, which seek to propel Saudi Arabia's economy to a new level by creating over a million job opportunities, homes for up to five million residents and contribute US$150billion to Saudi Arabia's Gross Domestic Product (GDP).

However, while this work is underway much has been done by HRH Crown Prince to improve, expand and diversify Saudi Arabia's existing major cities. Here, we will examine these cities to establish how the Minister for Municipal and Rural Affairs, King Abdullah and the Saudi government are transforming the country to maximise its potential as a global economic powerhouse.
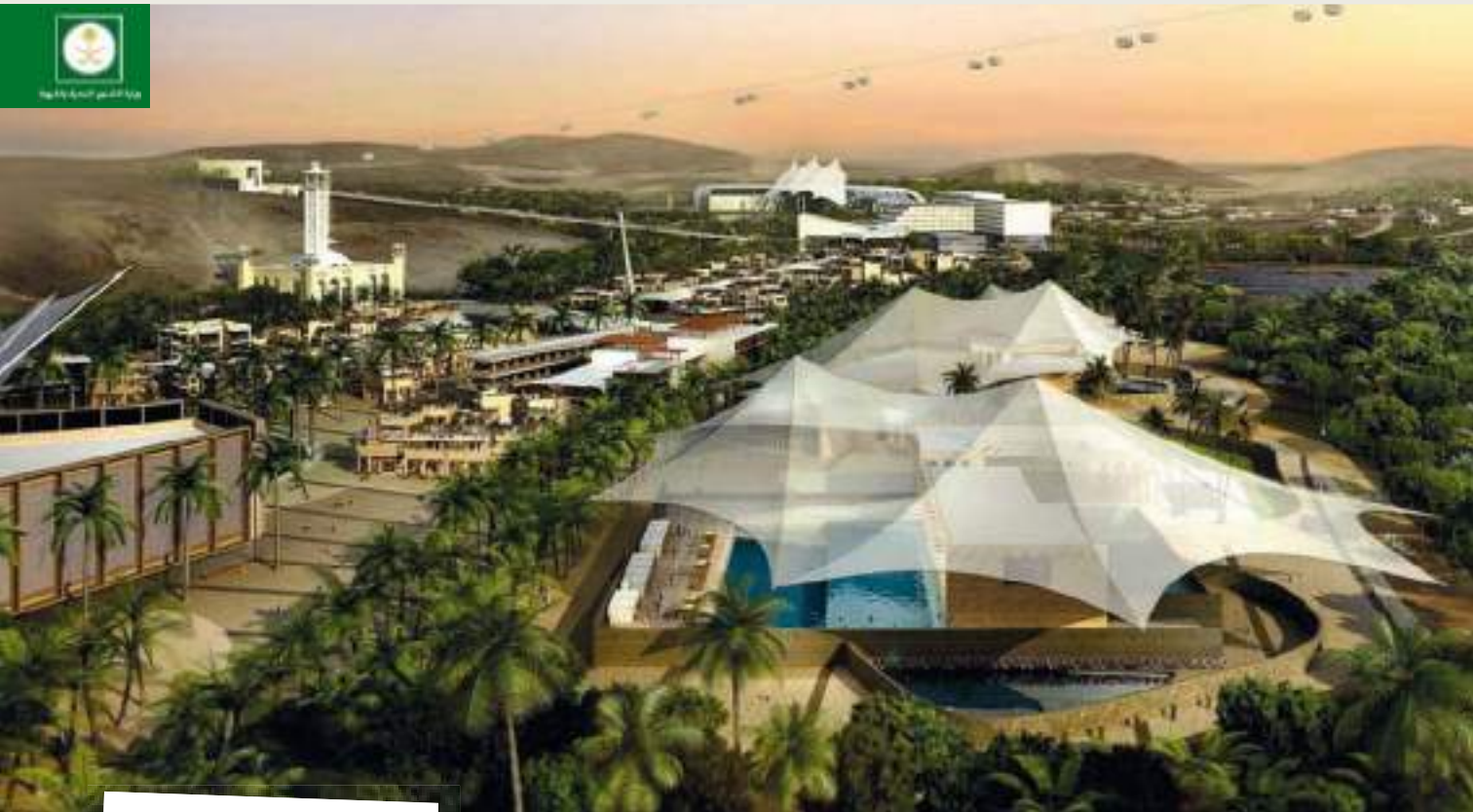
Riyadh

As the capital city of Saudi Arabia and the country's largest city, with a population of more than 5.8 million, Riyadh is now one of the richest cities in the Middle East.

It houses government ministries and the civil service. This created the need for a whole range of services, such as housing, and the development of a sophisticated urban infrastructure.

As the city's economy prospered it attracted increasing numbers of highly qualified new residents, and with the skills brought in by these newcomers the scope of business expanded beyond agriculture to include local and international trade and modern industries.

In addition to being the center of power, the city is also a commercial hub. Educational, financial, agricultural, cultural, technical, and social organisations have bases here.

The government has ploughed money into infrastructure with King Fahd road providing a main thoroughfare and a focal point for business and social activity. To bolster the public transport system a 25 kilometre electric sky train has been approved and the first phase will be installed in King Abdullah Road, King Fahd Road and Al Olaya Road.

The Holy City of Makkah (Mecca)

Makkah is the holiest city on earth for Muslims and five times each day, the world's one billion Muslims turn to the Makkah to pray.

Millions of Muslims each year also perform the Hajj – the pilgrimage to Makkah – which means the city's economy is widely focused on tourism to host the pilgrims.

In 2011, HRH Prince Khalid Al-Faisal Bin Abdulaziz, governor of Makkah, announced the Makkah Redevelopment Plan. It encompasses infrastructure, utilities, investment, financing, real estate and tourism projects to modernise the region. The US$27 billion development project is expected to change the face of the holy city by 2030.

In addition to this, the Makkah Gate Project, a new city will sit at the western edge of Makkah along the Jeddah-Makkah Highway. The site covers approximately 84 square kilometres and will house an estimated population of 690,000 people. It also incudes a new government district, financial district, university and research centre, exhibition centre, Prince Sultan Cultural Oasis, King Abdullah Dialogue Centre, craft and heritage village.

Jeddah

The Red Sea port of Jeddah, is a bustling, thriving city and seaport.

The population of the city is approximately 3.2 million and it is an important commercial hub in Saudi Arabia. It also serves as a gateway to the Holy city of Mecca and is a popular base for expatriates in Saudi Arabia.

The Jeddah Development & Urban Regeneration Company was formed in 2006, by Royal decree, to transform the city into a modern dynamic city.

To date, 14 projects have been identified, of which eight are in development, and range from housing projects to recreation and leisure facilities, a university campus and a technology park.

The Holy City of Medinah

Medinah is the second holiest city in Islam.

Like Makkah, much of the economy in Medinah is reliant on tourism from Muslim pilgrims.

However, SAIGA is building one of the country's new cities in Medinah – the Knowledge Economic City, which aims to boost development and increase the number of jobs in the region.

With an investment of US$7 billion, the new Knowledge Economic City will play a crucial role in transforming Saudi Arabia into a global force in knowledge-based industries. Its development will complement the work of the King Abdullah Foundation, creating an alternative central business district for Medinah with improved facilities and infrastructure, and a superior urban environment. It will include a complex for medical studies, biological sciences and health services, a business centre and an Islamic Civilisation Studies Centre.

Dammam

To the east of Saudi Arabia is Dammam, the most oil-rich region in the world.

The growth of the Saudi Arabian oil industry into the largest in the world brought about the rapid development of the region, which now boasts a population of well over 1.5 million, growing at five per cent a year.

Dammam was designed based on modern urban planning principles with residential areas separate from commercial areas. Land reclamation has also boosted the area with hotels and office buildings occupying what were once marshes.

In 2010 the Dammam seafront project was announced to expand the area's real estate and tourism market. The 3.3 million square metre development will include a 300,000 square metre lagoon, a waterfront shopping mall, open-air recreational areas and high rise residential areas. It will also encompass facilities such as educational, health, fire and police, a community centre and mosques.

Qassim

Located at the heart of the country, Qassim is one of Saudi Arabia's fastest growing cities.

Agriculture forms the basis for the region's economy, aided by an abundance of underground water, which means large quantities of grain, vegetables, and fruit can grow. Qassim is also rich in non-metal substances such as salt, kaolin, plaster, and marble and has become known for its industrial activity with factories producing cement, building materials, foodstuffs, chemicals, plastic and metal.

Future development in Qassim is centred on tourism, the regions' second biggest industry. The Saudi Commission for Tourism and Antiquities (SCTA) is working with a number of government agencies, particularly the Ministry of Municipal and Rural Affairs, to redevelop heritage sites and turn them into a productive economic sector.

Al-Hasa

Home to the largest oasis in Saudi Arabia, Al-Hasa has a dry, tropical climate. The reserves of underground water have allowed the area to develop its agricultural potential.

The oasis boasts two million palm trees. The agricultural production in the area is varied and it includes rice, corn, and citrus fruit. The Ministry of Agriculture has also set up a factory in the region to process its rich output of dates. There is also heavy livestock activity, with 200,000 sheep, 50,000 goats, 12,000 cattle and 15,000 camels. There are more than 15 extensive poultry farms that produce more than 100 million eggs and 30 million table chickens annually.

However, its location means Al-Hasa has to deal with tones of sand, which the wind carries. To counter this problem, large barriers of trees have been planted to prevent the sand from damaging inhabited and agricultural areas.

By Sir Peter Hall

NEW PERSPECTIVES ON TRANSPORTATION AND URBAN DENSITY

Urban planners around the world agree that the key to urban reform and creating sustainable cities is improved public transport infrastructure. However, an unresolved dilemma remains. Although experts seem to agree that we should aim to achieve more compact, higher-density cities, it seems that market forces are causing cities to develop in the opposite manner, spreading outwards and forming lower-density suburbs.

How do urban planners strike a balance and build suitable transit-networks that connect urban centres to ever-growing suburbs? Some experts argue that there is a solution. However, many believe there is not.

The case for public transport is twofold. Firstly, the underlying rationale is that diminishing fossil fuel resources and the imperative need to counter climate change will make it necessary to reduce dependence on fossil fuel travel. This is accepted by the majority of the world's scientific community.

Secondly, there is equal acceptance of the argument that urban sprawl will encourage more car travel. As homes disperse faster and more widely than jobs or consumer services, the said sprawl will increase journey lengths between homes and places of employment, and between homes and city-based services.

Encouraging People out of Their Cars

Australian urbanist Dr Paul Mees recently expressed a somewhat iconoclastic view on this matter. Dr Mees argues that the degree of automobile dependence in any city may be less of a reflection of urban form and density, and more an indication of the standard of public transport service.

To demonstrate this, Dr Mees showed that despite Toronto and Melbourne having similar urban structures with extensive low-density suburbs, Toronto achieved much higher transit use due to its high frequency of service that operated throughout the entire working day.

More recently, he extended his analysis to cover a wider range of differently structured cities, including Zurich, Vancouver, Ottawa, Curitiba and London. All of these cities achieve high levels of public transit use, whilst other similar places do not.

The key, Dr Mees argues, is to develop coherent networks. In a dispersed city, it is simply not possible to deliver a service that will do what the car typically does, which is to take the commuter, on command, from A to B. Yet, a transport system should offer seamless, convenient, easy and comfortable transfers at key interchanges. To achieve this, a city must develop a strong central infrastructure capable of achieving a high level of logistical coherence.

High-density versus Low-density Cities

Dr Mees argues that different cities, with varying geographies, have succeeded in developing a highly efficient transportation infrastructure, irrespective of their degree of urbanisation and dispersion. His research devotes an entire chapter to this issue, comparing densities and public transport use for cities around the world – a task that proved far from easy, because of the usual data problems.

Some odd results emerged from this research. Los Angeles, a metropolis with its notorious disregard for public transport, has the highest density of all of America's major urban areas, including that of New York City.

However, the city's car dependence arises not from this, but because its city planners made a conscious decision in the 1920s to become a different type of city. At that time, it housed the most extensive light railway network in the world, but decided to favour automobile dependence.

Likewise, Zurich – one of Dr Mees' key case studies – is not an archetypal high-density European city, as it occupies mountainous terrain with many of its suburbs being dispersed hilltop villages. However, all areas enjoy the same, uniformly excellent, level of public transport service.

Dr Mees shows in detail how this uniformity is achieved, with buses connecting to suburban railways at guaranteed times and with extraordinarily slick connections. He does not mention that, by the standards of other transport systems, this means a very high level of investment in interchanges that remain almost unused for long periods each hour. This highlights the fact that Swiss rail managers view their service in the light of passenger convenience, not for the exploitation of their infrastructure. This is a critical difference in culture, compared to other cities and countries.

The outcome, from Dr Mees' analysis, is that a city's density is not critically important. Relatively low-density cities can develop effective transport systems, if they are organised properly.

Does Density Matter when it Comes to Good Infrastructure?

Zurich is viewed by almost all comparative infrastructure studies as one of the best served public transport cities in the world. Dr Mees shows that the overall urban density of Zurich is quite low, which is also true of parts of the city with effective transit service.

One reason for this becomes obvious from even a superficial look at a map. Located in the Swiss Alps, Zurich concentrates urban development into relatively narrow valley corridors, which provide almost the sole practicable routes for fixed-route transit services, leaving wide mountain areas that are both thinly populated and bereft of transport.

For a different reason, a similar distribution is observed in the Swedish capital of Stockholm, another celebrated European model of a transit metropolis. Here, much of the metropolitan area consists of lakes, concentrating all development and transport on to the relatively narrow intervening land areas.

In both these and in other European cities, the residual areas can be intensively used for land or water-based recreation. In Vienna, a vast upland area northwest of the city, the Vienna Woods, is permanently reserved for open-air recreation, with urban development surrounding it in narrow river valleys. Interestingly, the few North American urban areas that are shown as performing relatively well

"To achieve urban sustainability through transport planning, there is no substitute for a good public transport system that delivers a smooth, interconnected service throughout most – if not all – of the 24-hour day."

in transit service – including Vancouver in Canada and the US cities of Portland in Oregon and San Francisco in California – share these physical characteristics.

Dr Mees' argument fortifies another contentious research conclusion, from Marcial Echenique, director of the UK's Engineering and Physical Sciences Research Council-funded *Solutions* study, in that urban form has virtually no influence on sustainable transport patterns. However, other members of Echenique's team argue that density does indeed matter, in terms of adequate services at the neighbourhood level – a point with which Dr Mees might not disagree. Still, whatever the precise parameters, it is true that a highly dispersed, low-density pattern of living and working makes it increasingly difficult to maintain adequate transit service.

The successful transit cities Dr Mees discusses are generally medium-density with a degree of higher-density clustering – often due to physical features, such as mountains or water bodies, which sharply reduce the amount of land available for urban development. Dr Mees' argument, and the case studies he uses to support it, raises intriguing debates on seeking alternative ways to promote sustainable urban form.

There are several basic variables. These include the distributions of employment, residence and other traffic-generating urban functions; the densities necessary to support adequate levels of service (however these are defined) by different public transport modes (bus, light rail, heavy rail); and, more subtly, the precise ways in which transport networks connect urban land uses and activities.

The 'Beads-on-a-string' Model

It is no accident that diagrams of the transit metropolis that appear in in the classic texts of sustainable urban development are all similar. They typically demonstrate a 'beads-on-a-string' structure, with urban development clustered along transit lines that feature pyramids of local density rising to peaks around public transport stations or stops. These stations also serve as locations for concentrations of public and private services, and hubs for employment.

The original model that excelled was the Stockholm General Plan of 1952, in which new suburban development was clustered around the stations of the planned metro (Tunnelbana) system, with pyramids of residential density, which rose to a maximum at the major sub-centres of each cluster, typically every five to six stations along each metro line.

At these points, the plan provided for high-rise, high-density development (typically eight to 10 storeys) within walking distance of stations and services, with lower-density family-oriented housing served by feeder buses that terminated at interchanges next to the Tunnelbana station. At other stations, medium or low-density development predominated, all located within walking distance, and accessible by pedestrian and bicycle friendly routes segregated from motor traffic.

This model has since been successfully followed in many other cities worldwide, notably in Singapore. It has also been adapted to other urban transport options (light rail in German, Dutch and now French cities; Bus Rapid Transit (BRT) in the Netherlands and Latin America), to other urban forms (such as linear cities like the Ørestad new town in Copenhagen), and to different density parameters.

In the region, the typical East Asian variant, represented by Singapore and Hong Kong, lies at the high-density extreme. European examples, in the Netherlands and Scandinavia, typically illustrate medium-density variants.

Connecting the Countryside

Finally, there is a remarkable recent variant on the pattern, literally following the 'beads-on-a-string' model. This model includes development in extended village clusters along tram-train lines, which run on the street in central cities but then divert on to national rail lines, to run through open countryside between the cities.

The pioneer of this model, in 1992, was Karlsruhe in southern Germany, where one route runs for 200 kilometres, connecting a series of villages between Karlsruhe and another town in southern Germany, Heilbronn. It was followed in 2007 by Kassel, a medium sized industrial and university town in Germany, which has created a regional tram network running up to 40 kilometres into open countryside.

Other European cities have followed, most notably in the Netherlands where, since 2011, the

new RandstadRail connects the cities of The Hague, Zoetermeer and Rotterdam by a combined tram-metro network, serving as the basis for extensive newly planned suburbs along the network and the tramlines that feed into the rail network.

Essentially, tram-train is a new technological and administrative innovation that is already demonstrating huge capacity to generate dynamic growth in expansive city regions around and between cities. This demonstrates the potential for new forms of urban growth.

The Challenges Facing Future Public Transport

To achieve urban sustainability through transport planning, there is no substitute for a good public transport system that delivers a smooth, interconnected service throughout most – if not all – of the 24-hour day. With this as its base, many different urban forms are then possible. However, it must minimise the

need for car travel, and maximise the opportunities for short trips on foot and by bicycle, and on short-distance public transport, by planning different key land uses – residential, service, local employment – in close proximity.

This will mean higher densities close to stations and transport stops. Just how dense will be a matter of local circumstance and local choice. For longer journeys, the basic urban transport infrastructure – whether metro, light rail, or BRT – will cater for the greater bulk of travel needs, comfortably and conveniently.

This is a pattern already achieved in many of the world's cities that are cited, again and again, as examples of global best practice, from Singapore to Stockholm, Karlsruhe to Kassel, Bogotá to Brisbane, Copenhagen to Curitiba, Strasbourg to Zurich. The challenge now is for other places to improve and build on the lessons that these model cities have experienced.

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By Dr Cheong-Chua Koon Hean

SINGAPORE:
Housing a Nation

Singapore's Housing and Development Board (HDB) houses more than 80% of the island's population. Over three million residents live in just under one million public housing flats across our small city-state of 710 square kilometres. Similar to cities with diverse competing demands for limited land, a high-density, high-rise housing model was thus a natural choice.

Yet, public housing in Singapore stands out internationally, as the HDB went beyond the provision of basic shelter to provide quality housing that residents can proudly call homes and a living environment that nurtures the development of vibrant and cohesive communities. This was achieved through long-term, integrated urban planning that optimised limited land resources, which provided highly liveable environments for its residents to live, work and play.

Today, through generous incentives and subsidies, approximately 90% of HDB residents own their homes, unlike many global cities where public housing is predominantly rental housing. Furthermore, to maintain high standards of living, the HDB has launched a variety of initiatives aimed at rejuvenating older towns and estates. HDB also encourages community bonding and promotes good neighbourliness amongst its residents. In spite

of its high population density and limited natural resources, according to Mercer's *2011 Quality of Living rankings*, the city-state still ranks among the top 25 cities worldwide in terms of quality of living.

Creating Liveable Towns and Homes

Long-term integrated urban planning

Long-term integrated planning is crucial for Singapore to ensure it is developed sustainably and that there is sufficient land to meet its development needs. At the national level, the Concept Plan – an integrated land use and transportation plan – takes into consideration the city-state's various competing land use demands. It also ensures land and infrastructure planning is strategic, integrated across various government agencies and oriented towards the long term.

To date, three such plans have been launched – in 1971, 1991 and 2001. As a result of these, the HDB safeguards land for public housing development in the form of satellite towns that are interlinked by expressways to one another, and ultimately with Singapore's central business district. Each town is complemented by regional and sub-regional centres and is serviced by the city-state's mass rapid transit (MRT) system.

All three concept plans have significantly shaped Singapore's physical landscape, with the HDB playing a major role in its overall development. Care is also taken to maintain greenery and water bodies in order to preserve the living environment. Since the establishment of the HDB in 1960, it has built 23 towns and three smaller public housing estates across the island.

Comprehensive Town Planning and Urban Design

Comprehensive and Self-sufficient

At the town level, the HDB adopts a comprehensive approach, exemplified by the holistic planning of towns as self-sufficient environments. Each town is equipped with a full range of facilities – such as schools, shops and recreational amenities – in order to serve the daily requirements of its residents and reduce the need to travel to the downtown city centre.

Town and Neighbourhoods

Each town is designed with a central hub serving several neighbourhoods. In turn, each of these neighbourhoods is served by precincts with supporting socio-communal facilities, such as kindergartens, shops and eateries, to meet the needs of residents. Typically, a town has around 25,000 to 50,000 dwelling units, while each neighbourhood has around 4,000 to 6,000 dwelling units. Within each neighbourhood are precincts of about 600 to 1,000 dwelling units each.
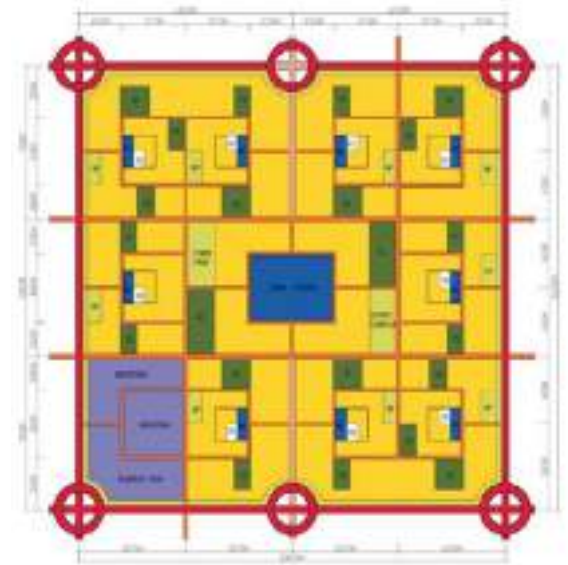
Hierarchy Design

To create a sense of structure, a hierarchical concept is adopted to help residents navigate their living environment. Facilities that serve more people – such as shopping complexes and hawker centres – are placed at the top of the hierarchy (the centre of the town), while facilities that are more localised – such as smaller supermarkets and mini-marts and eating houses – are placed further down in the hierarchy (within neighbourhoods and precincts). Similarly, parks, commercial facilities and educational amenities are allocated on a town, neighbourhood and precinct basis.

Seamless Connectivity

Connectivity was planned from the onset to allow residents to move efficiently within their town and to other parts of Singapore. The city-state's transportation network derives from a planned island-wide transportation plan. This incorporates bus interchanges and MRT stations, which are strategically situated in the centre of towns, as well as local roads within towns that connect to the major arterial roads and expressways.

To meet the rising need for greater connectivity and accessibility – particularly with an ageing population – barrier-free design features, such as ramps, ensure that residents of all ages have convenient access to public transport.

Checkerboard Pattern

Due attention is also given to ensure visual and spatial relief of high-rise, high-density HDB developments between each town. This is achieved by juxtaposing low-rise developments in a checkerboard pattern to create a more interesting and varied skyline for HDB towns.

Urban Design Guidelines

The HDB formulates urban design guidelines to ensure individual buildings and precincts relate to each other in a coherent and user-friendly fashion. Urban design studies are also conducted for strategic landmark projects as well as large-scale mixed-use developments in town centres. In this way, urban design serves to bridge the gap between land-use planning at the broader level and the design of individual developments. This enhances a town's identity and character.

An example of distinctive housing design can be found along the Punggol Waterway in the northeast area of Singapore. Here, the housing was shaped by urban design guidelines that encouraged tiered-buildings. The development features lower buildings in front and taller ones behind, thus creating a stepped terrace effect by the waterway. Within the development, courtyards and open spaces integrate seamlessly with the waterway promenade and surrounding landscaping, producing an urban environment that is visually pleasing.

Continual Improvements and New Planning Concepts

The design of precinct facilities and flats also plays a significant role in delivering high quality homes for residents. With this in mind, the HDB has applied new planning concepts that capitalise on the locality's unique characteristics. For example, in the regeneration of the Dawson Estate in the central Singaporean district of Queenstown, the planning vision was to provide housing in a park. In line with this concept, the flats were developed in a park-like environment, with greenery situated within the mid-levels of residential blocks, complete with sky gardens for panoramic views.

Besides introducing new planning concepts that strengthen identity and character, the HDB has also introduced improvements to community facilities. At the precinct level, for example, recreational areas that integrate the needs of three generations – the children's playgrounds, adult fitness facilities and elderly fitness stations – have been introduced to encourage interaction between the young and old. At the block level, the HDB void deck – an empty or void ground floor that is a unique feature of many HDB blocks – has been given a facelift. Using the lift lobby as the focal point, the block's drop-off porch, letterboxes, residents' notice boards, as well as tables and seats, are situated together to provide a stronger focal point for community interaction.

The design of HDB flats has also improved over the years. For example, flat layouts have grown more efficient, optimising the use of internal space. Wherever possible, the living room or bedrooms are also orientated to take advantage of the views outside. The windows of HDB flats today no longer face the common corridors unlike in the earlier years, in response to residents' preference for greater privacy.

Keeping Old Estates Relevant and Vibrant

Another unique aspect of public housing in Singapore is the extensive role HDB plays in estate renewal and rejuvenation. Here, the objective is two-fold: to ensure the quality of living in older estates and to retain the value of property in the estate. Rejuvenation also optimises land use wherever feasible, and helps bring in younger families to inject vibrancy into older estates.

In response to Singapore's rapidly aging population, HDB introduced its Lift Upgrading Programme (LUP) in 2001 to provide residents with direct lift access to every floor. The HDB has also implemented the Selective En bloc Redevelopment Scheme (SERS), for more comprehensive redevelopment. SERS aims to renew the physical and social fabric of an old estate by constructing new replacement flats next to older buildings. As residents move to brand new replacement flats with enhanced living environments, existing bonds and friendships are therefore retained. With the introduction of new and younger residents into these developments, the demographic of these estates remain varied and positively mixed.

In 2007, the HDB introduced the Home Improvement Programme (HIP), which sponsors essential improvements within older flats. In addition, residents can select value-for-money optional improvements for their flats and co-pay only what they have chosen. In the same year, the HDB launched its Neighbourhood Renewal Programme (NRP) that catered for comprehensive, integrated and coordinated external improvements, complementing those in surrounding neighbourhoods. These programmes further continue the work of earlier upgrading programmes such as the Main Upgrading Programme (MUP) and Interim Upgrading Programme (IUP), which were introduced in 1990 and 1993 respectively to provide improvements to precinct areas, blocks and flats. At the same time, they provide residents with greater flexibility and say in the improvements to their living environment.

Building Cohesive Communities

Besides its high-density environment, HDB's estates comprise a diverse population of different cultures and lifestyles. Thus, the building of cohesive communities, among residents of all backgrounds, is also very important.

In pursuit of this, the HDB has provided community spaces such as playgrounds and pavilions where residents can interact with one another and enjoy group activities. To ensure communal facilities and spaces cater to the needs of each community, the HDB regularly conducts consultations with residents to seek their views on various aspects of their neighbourhood.

The HDB has gone a step further in promoting bonding within communities - by organising welcome parties in newly-completed precincts for instance, to provide opportunities for residents to interact and forge friendships. The

HDB also promotes gracious living and good neighbourliness amongst residents. Since 2009, the HDB has awarded residents who demonstrate exemplary acts of neighbourliness with the Good Neighbour Award. These acts of kindness are publicised to encourage and inspire other residents to be good neighbours.

Meeting Future Challenges As Singapore Becomes Increasingly Built-Up

With an increasingly built-up environment, ageing properties and higher public expectations, the HDB will continue to work towards a better living environment and to meet the evolving needs and housing aspirations of our residents. The HDB's new initiative, *Roadmap for Better Living in HDB Towns*, will guide the organisation in meeting these challenges over the next five to 10 years. By building on past efforts and good practices, this roadmap emphasises the developing of well-designed, sustainable and community-centric towns.

Well-designed Towns

Well-designed towns will remain the HDB's focus, but these will move beyond good, functional, design to become neighbourhoods with greater vibrancy and character. To achieve this, in 2007 the HDB launched the Remaking Our Heartlands (ROH) initiative to achieve a more holistic approach to rejuvenate towns. An example is the remaking plans for the East Coast area was announced in January 2011, of which a key feature is to transform the Bedok Town Centre into a vibrant new hub by 2016. Residents can look forward to a shopping mall, an air-conditioned bus interchange and private residential units all integrated under one roof. To inject further vibrancy there will also be a new food centre, a town plaza and a new integrated sports complex. Detailed urban design guidelines are formulated to ensure better synergy and integration of the new facilities.

Sustainable Towns

In support of the Sustainable Singapore Blueprint initiative, the HDB pursues suitable green initiatives and urban solutions for its towns. HDB has already

> **Well-designed towns will remain the HDB's focus, but these will move beyond good functional design to become neighbourhoods with greater vibrancy and character.**

Bedok Reservoir Park

Outdoor Play Corridor

Rejuvenated Bedok Town Centre

Enhanced Connection to East Coast Park

Rest Points and Garden located along Bedok South

East Coast Park

Outdoor Play Corridor

developed its first eco-precinct - Treelodge@Punggol. This project, located in Singapore's northeast region, incorporates environmentally-friendly features. These include a rainwater harvesting system and water saving fittings to promote water conservation; and an additional rubbish chute at each block dedicated for recyclable waste to encourage recycling. Energy conservation initiatives, such as harvesting energy from the sun using solar panels, and tapping on kinetic energy created by moving lifts to generate electricity are also implemented in the development.

The HDB will continue to explore sustainable development initiatives on a larger scale. Punggol will be developed as Singapore's first eco-town. With the vision to become 'The Sustainable Waterfront Town in the Tropics', several urban solutions and environmental sustainability strategies are to be implemented. These include greener forms of transport, enhanced greenery and biodiversity, effective water and waste management, greater deployment of solar PV and smart grids, aimed at achieving greater energy efficiency, reducing carbon emissions and providing a clean and comfortable living environment.

Community-centric Towns

Going forward, the planning and design of HDB towns will continue to facilitate the building of cohesive communities and to promote harmonious living. In addition, HDB will also engage the community more frequently on matters and decisions affecting their living environment to ensure we cater to their lifestyle needs.

Conclusion

Singapore has limited land resources and a growing population. Never before has the city-state's need for land use optimisation been more pressing, nor the trade-offs between competing uses been so stark. The challenge facing HDB is to create innovative and sustainable solutions that meet competing land use needs, while maintaining a high quality living environment for its residents. The HDB will continue to capitalise on the opportunities presented by a high-density environment and will work with its multiple stakeholders to co-create urban solutions that transform the way Singaporeans live, work and play.

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From 2004 to 2010, Dr Cheong was the CEO of the Urban Redevelopment Authority, in charge of strategic land use planning, conservation of built heritage and the real estate market, in Singapore. She played a key role in the development of major growth areas, including Marina Bay.

She is also a Board Trustee of the International Urban Land Institute and serves on several international expert panels advising on sustainability and cities development.

Dr Cheong has been conferred several awards including the Meritorious Service Award for exceptional public service and the Convocation Medal for Professional Excellence (Australia).

By Dr Alfonso Vegara and Mark Dwyer

INTELLIGENT CITIES
in the European Diagonal

When we speak about high-density cities in the context of Europe, particularly with regard to southern European cities, we must qualify "density" in terms of compact urban form and networked city-regions.

European cities cannot compare to the high-density standards of Shanghai or Singapore and, therefore, we must redefine this connotation within a European context. We can describe European density less in terms of population or built density, but more in reference to cities that offer a high-density of urban infrastructure, services, creativity and innovation within a compact urban footprint. Therefore, the question of what makes a city more attractive and liveable must rest on the returns it offers to its inhabitants, and not simply by total population or a concentration of tall buildings.

The terms "attractive" and "liveable" are both subjective in nature, and are endlessly debatable metrics by which to measure modern cities. For this essay's purposes, we will consider "attractive" as it relates to the ability of cities to *attract* global talent, tourism and trade – characteristics which are ultimately interconnected with and influenced by the other term, "liveability".

INDICATORS AS BASIS FOR CONNECTIVITY MODELLING OF FIVE DIAGONAL CITIES AND DIAGONAL AS A WHOLE. CRITERIA: POPULATION LOCATED IN TRANSPORT CATCHMENT AREA; CATCHMENT AREA; AV. GROSS DOMESTIC PRODUCT PER CAPITA OF POPULATION REACHED BY TRANSPORTATION IN 4 HOURS

CITIES	Train	High speed Train	Airplane
Lisbon			
Potential passengers	4,271,348	16,367,286	11,711,766
Area [km²]	31,691	154,935	110,815
GDP/Potential passenger [euro]	14,102	14,982	16,578
Madrid			
Potential passengers	19,950,671	31,552,731	22,322,048
Area [km²]	245,418	357,391	186,206
GDP/Potential passenger [euro]	16,895	16,246	17,410
Barcelona			
Potential passengers	14,716,315	26,695,170	17,991,600
Area [km²]	120,655	267,137	132,120
GDP/Potential passenger [euro]	19,692	19,717	21,581
Marseille			
Potential passengers	25,179,390	53,415,202	19,663,438
Area [km²]	155,732	291,885	107,945
GDP/Potential passenger [euro]	29,097	26,782	24,432
Milan			
Potential passengers	30,434,217	80,335,526	34,126,385
Area [km²]	151,905	426,950	146,844
GDP/Potential passenger [euro]	25,469	25,802	28,601
DIAGONAL			
Potential passengers	85,921,646	134,842,204	67,268,398
Area [km²]	682,222	1,030,576	370,306
GDP/Potential passenger [euro]	23,497	23,587	23,955

Source: Fabio Casiroli based on GFK Macon database and Milan Politecnic.

Less than 15 years ago, individuals overwhelmingly selected a company or job before determining the city they would live. Yet, more recent surveys have revealed a completely new paradigm, particularly with regard to the more highly educated creative class, who now commonly determine the city before the job. This paradigm shift has mandated that global cities cannot compete in attracting or retaining talented individuals by providing attractive companies alone. They must also provide highly liveable environments, supportive of innovation and creativity, together with a safe, equitable and competitive urban venue that is well connected by transportation infrastructure.

In discussing the high-density environments of Europe, we will utilise the concept of city-regions. The term "city-region" refers to urban agglomerations, often historic or compact urban cores, and their surrounding territories. Together, these operate as a single, integrated urban model, sharing a population, major infrastructures, as well as economic and political arrangements.

With rapid urbanisation, some city-regions are developing sophisticated transportation, economic and environmental protection strategies, together with other metropolitan areas, thus creating a new type of extensive urban region or mega-region. High-speed rail networks that are integrated with airports and regional transit systems can improve mobility and strengthen economic links between individual cities within their polycentric networks. Parallel investments

❶ pg 44: Map of the European Diagonal – an emerging mega-region connecting the cities of Lisbon, Madrid, Barcelona, Marseille and Milan. Image courtesy of Fundación Metrópoli.

❷ pg 45: Indicators showing potential transportation demand, which provides a basis for planning the connections between the cities in the European Diagonal. Image courtesy of Fundación Metrópoli.

❸ pg 46: Figure ground and aerial view of each of the five cities in the European Diagonal. 1) Lisbon; 2) Madrid; 3) Barcelona; 4) Marseille; 5) Milan. Image courtesy of Fundación Metrópoli.

❹ pg 47: Map of the four strategic 'diamonds' in the European Diagonal. Image courtesy of Fundación Metrópoli.

❺ pg 48: The spatial distribution of a city's knowledge and research institutions can be construed as a proxy indicator of its capacity for innovation. Here, this mapping of innovation indicators is done for the city of Lisboa. Image courtesy of Fundación Metrópoli.

into urban regeneration, local economic development and environmental improvements are also made within the constituent cities themselves. These are made in order to ensure that every urban centre participates fully in the competitiveness of these mega-regions.

The European Diagonal

To illustrate the networked city-region approach, we can reference the emerging European Diagonal – a dynamic mega-region in the south of Europe linking the cities of Lisbon, Madrid, Barcelona, Marseille and Milan.

As a counterbalance to traditional European models in the industrialised north, the European Diagonal gives new coherence to emerging city-regions. It aims to connect economic and creative potential through a sophisticated system of airports, ports, highways and high-speed rail networks in Portugal, Spain, France and Italy, respectively. Recognising that cities can no longer compete in isolation, the European Diagonal assumes that cities are protagonists of new economic development, drivers of a knowledge-based economy, and cradles of innovation, creativity and culture.

The role of cities in a knowledge economy offers an alternative to high-density cities in the traditional sense, and concentrates on network density that ties compact cities together. The European Diagonal demonstrates the potential for interconnected city-regions to develop singularities that increase competitive advantages, while improving or maintaining a high level of liveability.

The European Diagonal explores how city-regions in Southern Europe can cooperate with each other to their mutual advantage by pooling their physical transportation networks. In a knowledge-based society, these physical networks are, in essence, means by which to generate and share knowledge. Soft networks, such as digital communication and information flows, are equally important to harness synergy between the specificities and competitive advantages of cities in such networks.

In the European Union (EU), the most prosperous cities and polycentric mega-city-regions are located in the European "Pentagon" – the historic core of the European Union. Together, these polycentric city-regions are able to compete with world cities and city-regions globally. In particular, the advanced producer services are concentrated among the largest and richest European city-regions, including London, Paris, Brussels, Hamburg, Frankfurt, Amsterdam, Zurich and Milan.

Since its inception, EU membership has fostered growth in more peripheral regions, including Ireland and cities in Southern Europe, which are now showing twice the growth rate in population terms than those of cities in the north of Europe, albeit from a lower starting

point. While the global economic crisis has greatly impeded recent growth, the future potential of the European Diagonal to connect intelligent city-regions will remain supported by an advanced system of connectivity and innovation.

Instrumental to the success of the European Diagonal is the contribution of city mayors at different levels and, in particular, in the five major cities of the Diagonal. The mayors share both an intimate knowledge of their cities and constituencies, as well as the capacity and willingness to connect across municipal and national borders to strengthen relationships, and create new opportunities. Mayors also have the agility – and often a greater urgency – to innovate, which can be more difficult to achieve working only at the level of national government in more bureaucratic structures.

> " The new connecting links with Lisbon and Barcelona open up options of cooperation and economic complementarity for Madrid, which were unthinkable only a decade ago. Madrid holds a key position in the strategies of interaction and cooperation between Europe and Latin America, which, in turn, is a fundamental asset for the cities within the Diagonal.
>
> Alberto Ruiz-Gallardón,
> Mayor of Madrid
> "

Spatial Development Strategies and Global Competitiveness

In order to position the European Diagonal´s potential in the global or European context, it is important to understand the spatial policies that structure and guide the EU member states, part of an ongoing effort to compensate for disparities at different levels of development.

The European Spatial Development Perspective (ESDP) is a policy framework that was adopted by the Ministers for Spatial Planning and the European Commission at the Informal Council of Ministers of Spatial Planning in Potsdam over a decade ago. It was the first initiative of its kind. Its principal objective involved the establishment of a structure of spatial strategy for Europe's member states, along with their cities and regions to ensure environmental and cultural sustainability, territorial competitiveness, and socioeconomic cohesion. Thus, the ESDP's strategy is based on an integrated view that builds on the notion that all sectors of activity influence each other in a community of countries and regions.

The ESDP's policies were structured around the following three goals. The first was to build a polycentric urban system and establish a new, stronger city-region relationship. The second guideline was to develop equal accessibility to information and infrastructure by means of improving integrated communication and transport systems. Finally, the policies were to ensure adequate management and protection of natural and cultural heritage, while promoting sustainable development. These guidelines were intended to preserve and reinforce a high density of urban services within a compact urban form.

The ESDP differs from the traditional physical planning approach in that it does not take on the spatial dimension in a reactive and regulatory manner by focusing explicitly on the physical and technical elements. Rather, it approaches the spatial dimension in a proactive and inclusive manner, breaking through territorial barriers and sectors. In this way, the ESDP pursues its goals simultaneously, and places a special focus on their interaction, as the combination of these goals can produce a balanced and effective territorial development. Furthermore, the ESDP is intended to serve as a reference for cross-boundary cooperation within the European territory.

Diamonds in The European Diagonal

Building the European Diagonal focuses on four strategic 'diamonds'; the Portuguese diamond, Mediterranean diamond (Spain), Cote d´Azur diamond (southern France) and the Alps diamond (northern Italy). The Diagonal development strategy aims at both strengthening polycentric links between cities within the identified diamonds, as well as generating new links between these 'diamonds' to establish coherence and common purpose across the

Diagonal and beyond, through its gateways to eastern Europe as well as North Africa and Latin America.

While the cities within the diamonds constitute the driving forces behind innovative development initiatives nationally, their dynamic energy is able to reach outwards into less populated countryside, dispersed and small settlements, and their rural activities. The purpose of the Diagonal is to further harness

this energy by establishing links between each of the diamonds, and thereby developing the weaker areas between them.

Establishing both hard infrastructure and softer people-to-people and organisational links between the diamonds is the most effective way to achieve this goal. It should be possible to obtain national assistance through direct financial aid, large scale infrastructure projects or new national policies, as generating

greater synergies among the cities within the diamonds is in a nation's interest, and likely to attract support. Creating links between all diamonds demands an innovative approach and must obtain supranational support.

At the diamond level, the diversity between the cities and their hinterlands provides potential for greater interaction and reinforcement of complimentary factors. Transportation links between diamonds could improve

their critical mass and generate activities in weaker areas at the same time. Bringing the diamonds closer together could also give rise to new symbiotic activities in their shared hinterlands.

The European Diagonal aims to establish a common understanding of the role of participating cities within their own diamonds in a sustainable development process. It also seeks joint interests that could be developed between diamonds across national boundaries. All participating cities have their own interests to consider, and a need to identify worthwhile objectives to join forces at the city cluster, super-city, diamond, regional, cross-border or Diagonal scale. Different issues, projects, or policies warrant varying scales of cooperation.

Projects at different levels, including those undertaken by individuals and small businesses, can benefit from greater connectivity and access to other cities and regions. Without these networks many actors must operate in isolation, which limits innovation and access to creative partners, investors or consumers. A better knowledge base of cities and their development potential at city, city-region and especially at diamond and Diagonal levels is considered essential to achieve a consensus on development projects within a common spatial strategy.

The Malacca Straits Diagonal

The model of density for networked city-regions is not exclusive to the European continent. One of the strongest concepts to emerge from the ASEAN region in recent history is that of the Malacca Strait Diagonal.

The Malacca Straits Diagonal connects more than 16 million urban inhabitants by land, primarily along the Malaysian

Peninsula. This is done through a system of national highway and rail corridors, sharing a strategic coastal orientation with the Malacca Straits opposite Sumatra in Indonesia. This concentration of interconnected high-density urban centres, economies, cultures and people will establish the Malacca Straits Diagonal as a driving force in the ASEAN economy for decades to come.

In the future, this vibrant economic corridor could be driven by high-speed rail connectivity spanning from Penang in the north to Iskandar and Singapore in the south – a rare opportunity in an otherwise geographically fragmented region.

Innovation and Connectivity

At the heart of the European Diagonal is its ability to combine innovation with transportation infrastructure to result in greater connectivity of knowledge and access to resources throughout the Diagonal.

Innovation is an abstract concept; nevertheless, identifying places of learning, technological and scientific development can be construed as a proxy indicator of a city's contribution to the knowledge base. The spatial distribution of these places shows their degree of integration into the city's socioeconomic fabric, which can provide a basis for strategies to develop, nurture and retain indigenous human capital.

Various models have been devised to increase the efficiency of such spaces for the creative economy. Clusters have become an orthodox approach, but merits are also seen in networked spaces interspersed throughout the urban fabric. Regardless of the economic models, information on the spatial location, relation and distribution of places for creative activities and knowledge on their synergistic interaction together provide important input into urban strategies.

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MAIN UNIVERSITIES

SCIENCE AND TECH PARKS

By Yang Baojun

PLANNING STRATEGIES FOR LIVEABLE HIGH-DENSITY CITIES

This article is a translated extract from Yang Baojun's original essay in Chinese, which appears in full on pages 76–79.

People the world over view low-density urban environments as natural, beautiful and, therefore, liveable. In contrast, high-density cities are seen as unliveable due to congestion and noise. In reality, this is not the case. Liveability is a comprehensive topic with multiple facts, and high urban density has both positive and negative effects on liveability.

On the positive side, a higher population density can make economic operations more efficient, as this supports greater commercial opportunities and creates ample jobs. High-density cities also offer residents a variety of lifestyles and opportunities for interaction.

The negative impacts of urban density can include lower environmental quality and traffic congestion. Yet, a high-density city can avoid these adverse effects and achieve a higher quality of life through technical innovation, scientific planning and management. The successes of cities like Singapore, Hong Kong and Tokyo can be used as reference points for high-density development. There are two aspects to consider with respect to liveability in a high-density city: strategic planning concepts and planning management systems.

Strategic Planning Concepts

Blending Green Areas with Compact Cities
To use land efficiently, the optimal use of good land and minimal use of scabland is essential. There are significant differences in land-use potential in terms of location, resource endowments and development stages. Homogeneous land-use weakens the capacity to use land intensively. It also reduces the ability to make good use of natural environments that are unsuitable for urban development. From economic, social and environmental perspectives, the optimal use of good land is a strategy that will maximise benefits.

To implement this strategy, cities must first protect green open spaces by exercising control over construction on farmland and ecological areas. They must restore the ecology, improve leisure options in these places, and sustain a macro-ecological environment on which high-density cities depend. Then, they must build compact and efficient cities. Preparation for building these includes installing public facilities and infrastructure, investing in high-density projects, and instituting efficient construction management in order to economise our land resources.

To prevent disorderly growth, a long-range spatial structure of the city should, firstly, be established.

Within this structure, both built-up and undeveloped areas must be designated, and an urban growth boundary defined. A legally binding planning tool must also be employed to exercise control over the growth of the city in free market conditions.

Case Study: Hong Kong, noted for its high density development, is a leading example when it comes to blending green areas with compact cities. While incorporating high-density development to house its population, the city gives strict protection to non-urban areas. Today, land use for urban development accounts for less than 20% of the city's total area, with the remaining spaces reserved as forestland and farmland. As a result, the city's natural environment enjoys a high-level of government-led protection.

This decision also means the city's operations are very efficient, as most urban areas are inter-linked. This is exemplified by Hong Kong's mass transit system, which has – for some time – been one of the few profitable systems in the world.

Combining a Regional Ecological Matrix and Urban Ecological Patches
According to landscape ecology theory, a natural ecosystem consisting of a complete 'patch-corridor-matrix' structure should be set up. This system involves the interspersing of high-density city buildings with public open spaces, hills and waterways. The purpose of this is to safeguard green open areas that are used for ecological and recreational purposes.

Case Study: Singapore is a leading example of interspersing urban infrastructure with public open spaces. The city allocates more land than Hong Kong to urban development, yet there is a clear distinction between built-up urban areas and non-developed areas. Adjoining nature reserves provide urban areas with an effective ecological service and leisure spaces. This prevents the environment in Singapore from rapid deterioration due to contiguous urban development. Singapore's nickname - 'the garden city' - comes from its built-up areas enjoying a near-equal environmental quality. This is why the city-state's urban environment is admired by its population.

Controlling the Urban Cluster Scale
Clusters are municipal areas that provide basic public services and are integral components of urban structure. A reasonable cluster scale provides for basic urban services and gives a rational structure for urban planning. Balanced functions within clusters contribute to a lower transport demand across clusters.

Controlling a cluster-scale prevents contiguous development of the city. Ecological corridors between clusters improve urban microclimates and produce healthy, natural, environments for urban development.

When urban expansion reaches a certain stage, it moves from an agglomeration economy – an economy that benefits from multiple businesses being located next to one other – to a diseconomy that lacks this trait. At this point, any expansion of the city should cease, and efforts should be diverted to building new towns and districts.

> **" Choosing a sound strategy that balances residential areas with parks and offices, a good public transport system, and the sustainable use of energy, water and waste are all key to the survival of today's and tomorrow's cities. "**

In doing this, attention should be paid to ensure a reasonable cluster-scale. A small scale will not enjoy agglomeration effects, and will lead to public infrastructure diseconomies and high operating costs.

Case Study: In order to relieve overcrowding in London and accommodate high migration to the southeast of England, the UK government sought to develop a generation of new towns in the region. Among them, was Milton Keynes, which successfully balanced providing ample jobs and adequate housing with stable population growth.

Construction began in 1970 and by 1981 the city had grown from 35,000 to 120,000. During this period, Milton Keynes maintained its moderate-density and a reasonable cluster scale, and managed to sustain its public services, business prosperity, and high environmental quality.

Covering 89 square kilometres, Milton Keynes' urban design is divided into many squares in a grid pattern, with ecological greenways carved into clusters of suitable scale. The town has a central business district that – like most urban centres – combines spaces for public entertainment and recreation. Surrounding the new town are dense forests and more than 10 manmade lakes.

Integrating a Mass Rapid Transit and Slow-moving Traffic System
A high volume of human and goods movement enables the development of a mass rapid transport system. This turns scattered traffic into efficient community traffic by making good use of urban spatial resources, lowering the per capita consumption of resources, and reducing pollution. This clearly demonstrates how a high-density city is superior to a low-density one.

❶ **pg 50-51: Hong Kong has embraced high-density development and yet preserves a significant amount of green spaces.** Photo credit: © 2012 Thinkstock

❷ **pg 52: In Hong Kong, land use for urban development is kept compact, with the remaining spaces reserved as forestland and farmland.** Photo credit: © 2012 Thinkstock

❸ **pg 53: Singapore's densely built up areas are interspersed with public green spaces, creating a pleasant urban environment.** Photo by the Centre for Liveable Cities.

❹ **pg 54, above: Map of Milton Keynes town.** Image courtesy of Yang Baojun.

❺ **pg 54, below: Skyline of Tama New Town.** Photo courtesy of Yang Baojun.

Public transport-led urban development emphasises the combination of transport with land use and strengthens integration among urban systems. It is a higher form of urban spatial resource planning and is more efficient in terms of land use.

A mass rail transport system can sustain a city's extensive and comprehensive development, its highly concentrated population and its economic activities with rail transit stations at the core. A common practice is to integrate these stations, public activities and service centres, with park and ride facilities and public transport interchanges.

The mass rail transport system is intended to tackle difficulties faced by people travelling long distances within a city, while a slow moving traffic system is meant for people travelling short distances. The latter is complementary to the former, providing a way of travelling the last kilometre from a rail station to the workplace or home. In a conventional system for slow-moving traffic, there are lanes on either side of the motorway. It is, therefore, still vehicle-oriented. For a system to be fully people-oriented, safe and convenient, it must meet certain criteria. It should be built independently of motorways, be capable of meeting the needs of commuters, fulfil recreational functions, and ensure commuters enjoy a stable journey.

Case Study: Tokyo is densely populated. The city faced the problem of overcrowding after Japan recovered from World War II and experienced rapid development in the 1960s. It was against this backdrop that the construction of Tama New Town began in 1965. Of all the new towns in the greater Tokyo region, Tama is

the most successful. It stretches 14 kilometres from east to west and between one and three kilometres from north to south. Its planned population today stands at approximately 340,000 and is divided into 21 neighbourhoods with 3,000 to 5,000 families in each.

There are two primary schools and one secondary school in each neighbourhood. Several neighbourhoods combine to form a district, and at the centre of each district is a rail rapid transit station, linking Tokyo's city centre and other towns via the Tokyo railway networks. The rail transit station can be reached from every neighbourhood or residential unit on foot, by bicycle, public transport or car. The area around Tama central station has been developed to act as the centre for the new town, complete with commercial, business and recreational facilities.

Encouraging a Mixed Use of Urban Land
An industrial-age city emphasises functional zoning, with industrial land, residential land and land for common facilities clearly demarcated. The purpose of this was to separate any industrial land that created greater air, water and noise pollution, from residential areas in order to preserve a pleasant living environment. However, in a post-industrial society, most people work in places that no longer cause pollution. This creates novel conditions for the mixed use of urban land.

Mixed-use developments help bring about a balance between work, housing and recreation within the limits of non-motorised commutes. This balance sees a return to the traditional urban spatial model and lifestyle with the following notable advantages: making tasks convenient for people in their daily life; relieving traffic pressures; reducing energy consumption; contributing to a healthy and dynamic urban community; and the promotion of a prosperous city.

In the course of building new towns and districts, similar attention must be paid to striking a balance between work, housing and recreation. This avoids the growth of a 'dead city' where there are too many jobs and too few residents, or the emergence of a 'sleeping city' where there are too many people and too few jobs.

Developing Efficient Water, Energy and Waste Systems Use
Harvesting a city's natural resources and the collection, disposal and recycling of its waste – including wastewater,

refuse and waste gas – continues to be a major challenge worldwide. Maintaining a stringent and high standard of execution in all these areas requires state-of-the-art technology and robust management systems.

For the utilisation of resources within a city, urban planners and developers should adopt the '3R' principle: reduce, reuse and recycle. Cities must reduce the import of outside resources and develop recycling technology that turns waste into a resource, which in turn, can be used in the operation of city systems.

Establishing a Disaster Prevention System
Natural and man-made disasters come in many forms. It is critical, therefore, that a sound and comprehensive urban-security system is set up within a city. This system must conform to the distinguishing features of the city, maximise disaster prevention and minimise losses from disasters. An emphasis should be placed on cooperation and coordination among functional systems, including disaster warning, transport, communications, storage of emergency supplies, and evacuation.

The disaster prevention system is an emergency backup plan that uses various resources operating under normal conditions. To increase the efficiency of resource use, as well as improve safeguards for facilities, disaster prevention facilities should share the use of other urban facilities. For example, a city might build a park and an evacuation area together so that they share transport and communication facilities.

Planning Management Systems

Legal System
A robust legal framework is a prerequisite in all areas of planning and implementation. Such a system should safeguard the rights of all, mobilise social resources, and connect diverse information. Effective supervision is needed during implementation, and irregularities must be restrained.

Public Participation
Key to ensuring fair and impartial planning, public participation throughout the entire process of planning and

implementing urban solutions should be promoted as much as possible. This safeguards the legal rights of the public and other interested parties, prevents corruption and avoids mistakes in decision making.

Stringent yet Dynamic Planning
Scientific planning and strict adherence requires stringent mechanisms to draft, approve, evaluate and maintain plans. In the wake of changing conditions, plans will need to be constantly updated for them to make more sense as time progresses. Such plans will continue to improve resource efficiency and become a blueprint for a city to develop effectively.

Grassroots Organisations
Nurturing community ability and an advanced community culture requires attention. When the natural bottom-up organisational ability of a city and its conscious top-down planning are coordinated, a city is better able to advance itself.

Conclusion

More than half of today's global population lives in urban areas. With this figure growing at an unprecedented rate, planning for tomorrow's cities has become a foremost priority for nations worldwide.

Despite the common perception of high-density cities being over-congested, under-resourced and polluted, developed cities in Asia – and select cities from Europe and the US – have proved that high-density urban areas can have a positive impact on liveability. Choosing a sound strategy that balances residential areas with parks and offices, a good public transport system, and the sustainable use of energy, water and waste are all key to the survival of today's and tomorrow's cities.

> "The negative impacts of urban density can include lower environmental quality and traffic congestion. Yet, a high-density city can avoid these adverse effects and achieve a higher quality of life through technical innovation, scientific planning and management."

Yang Baojun is Vice Director of the China Academy of Urban Planning and Design (CAUPD). He is also the Chief Planner.

SINO-SINGAPORE
GUANGZHOU KNOWLEDGE CITY

PAVING THE WAY FOR FUTURE CITIES:

GUANGZHOU KNOWLEDGE CITY

Singapore and China have once again come together to create another landmark project – the Sino-Singapore Guangzhou Knowledge City (GKC Project). Designed to pave the way for a knowledge-based economy of the future, the GKC Project will set new benchmarks for quality living, a business-friendly environment and efficient governance.

ABOVE: AERIAL VIEW OF THE GKC PROJECT START-UP AREA
RIGHT: ASCENDAS ONE HUB GKC – AN INTEGRATED BUSINESS PARK

Over-population in today's cities is a challenge facing governments from around the world, but nowhere is the issue more pressing than in Asia. By 2050, the world's urban population is expected to reach seven billion people and in Asian cities alone, it is projected to reach 2.5 billion by 2025.

21st century urbanisation brings with it new environmental, economic and social challenges, yet it also presents a unique opportunity to build more sustainable, vibrant and innovative cities to counter them.

The GKC Project is such a place. A landmark development envisioned by the governments of Guangdong and Singapore and executed by Sino-Singapore Guangzhou Knowledge City Investment and Development Co., Ltd, a 50:50 joint venture between Guangzhou Development District and Singbridge International Singapore, the development will leverage on Singapore's experience to help drive Guangdong's economic restructuring,

environmental enhancement and social development. It will also be a model for other cities worldwide to look up to and emulate.

Previously, factories for low-end manufacturing dominated the Guangdong region. In the near future, this new city will deliver knowledge-based industries centred around R&D and technological innovation, thereby raising the overall socio-economic state of Guangdong with better paying jobs, better services and better quality of life.

Six industries in particular will be at the forefront of the City's economy: next generation information and communication technology (ICT), biotechnology and pharmaceuticals, clean technology, next generation materials, culture and creative industries, and science and education services. In addition to these, the GKC Project will also be developing its 'Headquarters Economy' capabilities.

However, what sets the City apart from other such developments across the world is its 'software'. Not the type you find in a computer, but the metaphorical kind – a blueprint. In this context, software refers to the policies, processes and methods that are used to plan, develop and manage a city. These include urban design, environment, infrastructure as well as economic and social development.

In its aspiration to serve as a manual for other such cities, the GKC Project will set out best practices on

successful urban planning by drawing from past experiences in both China and Singapore. The GKC Project will also encompass four strategic development platforms, namely:

Smart City
The GKC Project will be a smart city that looks at all facets of running a city, ranging from efficiency of transport, sustained economic growth, strong governance to the sustainable use of resources.

Eco City
The GKC Project will be an eco-city, making the most of energy efficient solutions. All buildings will comply with green buildings standards, while roads will feature green modes of transportation. In addition, the city will also be a hub for eco-technology investments, from upstream R&D through to testing and commercialisation, by attracting world-leading companies in this field.

Learning City
The GKC Project will also be a learning city, with all residents having access to a quality education and information. New technologies and innovative teaching methods will be combined to help cultivate a literate, well-informed community with a lifelong commitment to the pursuit of knowledge.

Design City
And finally, the GKC Project will be a design city. It will become a leading centre of innovation, creativity, and design excellence for China and the rest of the world.

GKC Project: The Facts
Sino-Singapore Guangzhou Knowledge City (GKC Project) will cover an area of 123 square kilometres (sq km) with a built-up area of 60 sq km amidst existing forest-covered mountains, protected green spaces and water bodies.

When completed in five to eight years' time, the 6.12 sq km Start-Up Area (SUA) of the GKC Project will be easily accessible to Guangzhou's Baiyun International Airport (just 25 kilometres away). In addition, the SUA will also be connected to an extensive transport network of expressways, highways, metro lines and inter-city rail links which will allow commuters to reach downtown Guangzhou in under half an hour, as well as provide access to other major cities in the Pearl River Delta region.

A good mix of quality housing, vibrant commercial districts and high-tech industrial parks, offices and R&D facilities are available within the City. Together, they offer residents and visitors a fully suited lifestyle for work, live, learn and play. Communities will be well served by conveniently located neighbourhood centres and schools – both public and international. Signature landmark buildings, lush greenery, and a scenic lake at the heart of the SUA will help ensure a rich urban landscape for all its inhabitants.

Projected to complete by 2030, the GKC Project will create over 250,000 jobs and be a home to more than 500,000 residents.

To find out more about this exciting new city, visit www.ssgkc.com

By Khoo Teng Chye

THE CLC FRAMEWORK

for Liveable and Sustainable Cities

Khoo Teng Chye is the Executive Director of the Centre for Liveable Cities (CLC), a Singapore-based knowledge centre with a mission to distil, create and share knowledge on liveable and sustainable cities. The CLC Framework was conceived by Dr Liu Thai Ker, Chairman of CLC; and developed with inputs from Cheng Hsing Yao, Chng Kai Fong, Dr Limin Hee, Prof Lily Kong, Leong Ching, Donald Low, Aaron Maniam, Prof Neo Boon Siong, Ng Wai Keen, Serena Wong, and Yang Wen.

Singapore is a densely populated metropolis with more than five million inhabitants living on 710 square kilometres of land. In liveable city surveys over the last few years, including Mercer's *Quality of Living Survey* of 2011, Singapore is one of few high-density cities that are able to achieve high liveability standards.

In the 1960s, it would have been hard to imagine that Singapore – then a fledgling nation troubled by high unemployment, urban slums, poor infrastructure, lack of sanitation, and an unskilled labour force – would make the leap from a developing nation into a thriving global city in the space of 40 years.

Today, many highly liveable cities exist in large geographical spaces with low-rise developments, less dense populations and low-polluting industries. Cities such as Sydney or Vancouver are often cited. Singapore is one of the outliers that have combined highly dense urban structures with high standards of living. This

The CLC Liveability Matrix
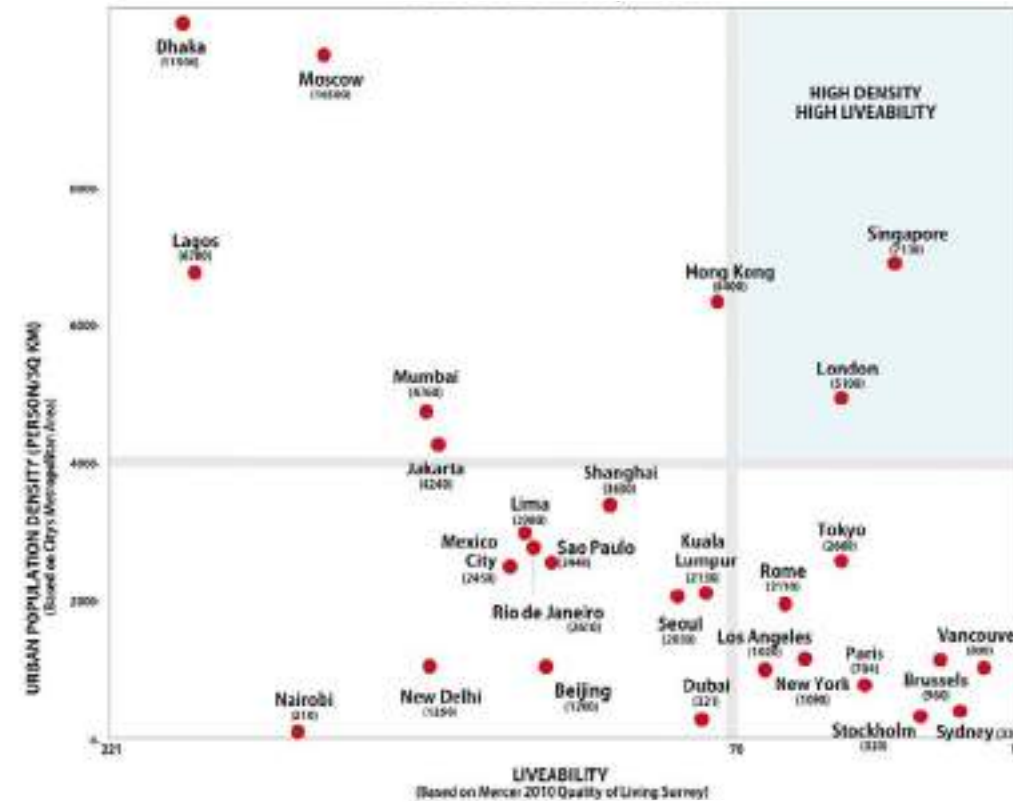
represents an intriguing possibility that high-density living does not have to compromise on quality of life.

How is this achieved? And, what has Singapore learnt in the process? These are key questions that Singapore's Centre for Liveable Cities (CLC) will address.

Method: Urban Systems Studies

When Singapore's pioneering leaders started to build the city, they did not have a particular framework in mind, or a written set of principles and guidelines. CLC's challenge is to distil these – not just the formal institutions of urban development, but also the tacit knowledge from those that led Singapore's urban planning and governance over the decades.

In exploring these, we paid special attention to the role of key actors, enabling processes and innovative policies that we believed to be crucial to understanding the transformation of Singapore. The basic units of analysis were the institutions, which we defined as "rules of the game." Formal institutions include the law, formal rules and regulations, and structures of governance. Informal structures include norms, principles and values. These research outcomes are captured in CLC's ongoing research in Singapore's urban systems.

Snapshot of the CLC Framework

The purpose of the CLC Framework is to provide a lens through which city leaders can view their cities and analyse the actions or approaches open to them to achieve high liveability.

Three outcomes have been constant in how Singapore envisioned liveability. First, Singapore needed a competitive economy in order to attract investments and provide jobs. Second, the city has to survive with limited natural resources in terms of land and water. Thirdly, it has to maintain an acceptable quality of life, which includes addressing environmental and hygiene problems, as well as providing affordable education, housing and healthcare. These three outcomes are highly visible, and could be a statement of policy goals. But what are the processes and mechanisms that enable this

CLC Liveability Framework

> " **Singapore is one of the outliers that have combined highly dense urban structures with high standards of living. This represents an intriguing possibility that high-density living does not have to compromise on quality of life.** "
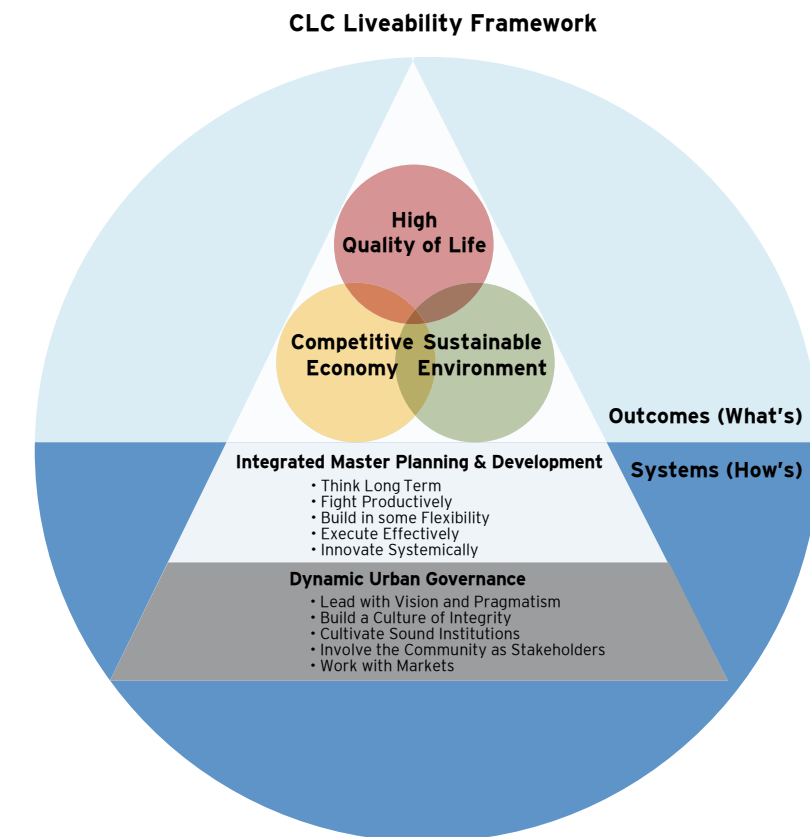
transformation? What are the "rules" that must be in place to sustain these desirable outcomes?

In short, how did Singapore achieve these outcomes? These mechanisms or operating "rules," are not so apparent.

We explain this with the CLC framework graphically represented by the diagram above. As a working hypothesis, we take two elements as key in understanding the institutional change of Singapore – first, integrated planning and development, keeping the outcomes of a liveable city in view over the long term; second, urban governance of a dynamic nature that sustains the conditions for a liveable city to thrive.

The Liveable City Outcomes

These outcomes have remained consistent over the last 50 years. From Singapore's experience, there are often no absolute levels whereby liveability is met. It is more often than not about

optimising the trade-offs at each stage of development, adapting to the circumstances and challenges prevailing at the time.

**Outcome 1:
A Competitive Economy**
The presence of a competitive economy is crucial to a city's liveability. Residents must have the opportunity to make a living and achieve a degree of economic security. Likewise, the city must be able to generate income in order to sustain itself, invest and create further opportunities for economic growth.

Singapore's urban systems have had an integral role in supporting the country's economic development. This includes the allocation of land and facilities for industrial use, transportation networks, and the supply of water and the provision of sewerage facilities. Its economic policies have also been dynamic and adaptive to changing global conditions, with government agencies well-aligned to compete for foreign investments for development.

**Outcome 2:
A Sustainable Environment**
Environmental sustainability also means the long-term sustainability of resources that are vital to the survival and functioning of Singapore. As much as the Singapore government placed huge priority on economic development in the early years, it did not take the "develop first, clean up later" approach of many developing nations. The city-state brought environmental protection in line with both economic development and city planning.

During the 1960s and 1970s, Singapore paid attention to a clean and green environment in order to improve public health, inculcate social responsibility, and show foreign investors that the country was well-run. Environmental values were therefore embedded into a larger social and economic narrative by framing it as a means to distinguish Singapore from regional peers. This was key in understanding how environmental concerns had an early and important place at the policy table.

**Outcome 3:
A High Quality of Life**
In the early stages of Singapore's development, slums, squatters and substandard living conditions were prevalent. At that time, improving quality of life would have incorporated basic accommodation, sanitation and an elementary public health system.

In order to meet this, Singapore's Public Housing Programme provided accessible and affordable housing and amenities for its citizens. Till today, it encourages home ownership with over 80% of Singaporeans living in apartments built by the Housing Development Board (HDB). The government also made a conscious decision to keep Singapore green and more pleasant for its residents. Social integration has, likewise, played a part in the building of Singapore. Initiatives such as the 2004 Active, Beautiful and Clean Waters (ABC Waters)

Programme sought to transform urban infrastructure into aesthetic landscapes and recreational spots. Numerous cultural initiatives have given rise to the city's Esplanade theatres, various museums and cultural venues.

Integrated Master Planning and Development

Integrated master planning goes beyond the making of physical plans. It addresses the need to optimise planning decisions such that the outcomes for the environment, economy and quality of life can be balanced, especially with competing demands for use of limited land. It must also ensure that meeting long-term outcomes as well as short-term needs are optimised. But the key differentiating factor for Singapore's planning is that its plans do not stay just on paper – they are implemented and executed with dedicated organisations, expertise and resources.

Implicit "Rules" of Integrated Master Planning and Development
At each stage in the integrated master planning and development process, there have been five implicit operating "rules" that have remained remarkably consistent over the years.

Rule 1: Think Long Term
Thinking long term helps officials keep the three outcomes in balance at both the planning and implementing stages. A longer-term view can also help planners make decisions on developing a good project that may be before its time. Long-term thinking provided government agencies with a sense of mission and direction, and at every point in time, rigorous decisions in evaluating and implementing projects have to be made to deal with challenges based on the best knowledge and information available at that time.

Rule 2: Fight Productively
In a rational, interest-based analysis, government agencies tend to focus on their own targets rather than the larger goals of government. An inter-agency structure forces various government departments to acknowledge each other's concerns and goals. Such a structure, and the resulting processes, gives room for "productive fights". A fight is productive when it helps officials to surface their concerns and differences, challenge proposals, and reach decisions on planning and implementation that optimise the three liveability outcomes. Unresolved issues are escalated for resolution by considering overall strategic goals and national interests.

Fights are not just a result of different interests, but also sometimes, of different perspectives. For example, our research has shown for example, some instances where political and professional ideas and assessments diverge. In these cases, it is not mere power that resolves the issue – there is a historical and deep respect for professional expertise in public policy planning and implementation in Singapore.

Rule 3: Build in Some Flexibility
While planning is necessarily for the long-term and done in some detail, city planners need to accept that no plan is perfect, just as no future is predictable. Planning needs some operational flexibility. Regular reviews of land use and development policies take into account new technologies, changing circumstances and public feedback. This process allows for the re-evaluation of development strategies as well as the strategic and specific land use plans to cater for changing economic and social needs.

Rule 4: Execute Effectively
A plan is only as good as its successful implementation. The Government set up action-oriented agencies or statutory boards for implementation of policies and programmes in view of larger national objectives.

The emphasis is on delivering the mission. In this, leadership, especially in the civil service and statutory boards, professional expertise and clear benchmarks and indicators of performance, have made a crucial difference. Technocratic excellence is also sustained by committing the necessary resources to ensure that agencies stay on track.

Rule 5: Innovate Systemically
Singapore learns from the experience of many countries. But, instead of merely imitating successful practices, officials seek to understand the underlying causes and then adapt the principles to the local context to achieve its policy objectives. This systemic mindset has led to many policy innovations in dealing with urban development challenges in Singapore. Through continuous experimentation, learning and adaptation, Singapore has achieved significant breakthroughs in areas such as economic development, public housing, water management, transport regulation, and industrial infrastructure.

Dynamic Urban Governance

Singapore's geographical scale and structure of government allows for efficiency in policy formulation and implementation. Having delivered on security as well as economic and institutional development, Singapore's urban governance challenges lie in achieving dynamic and effective governance that enables public leaders and citizens to interact to make optimal decisions and choices in an environment that is unpredictable and constantly changing.

Implicit "Rules" of Dynamic Urban Governance
Urban governance refers to the manner in which public leadership interacts with citizens and other stakeholders to make decisions regarding, and have oversight over how a city plans, develops, utilises and manages its physical and environmental resources to achieve national outcomes. Of the many implicit "rules" that had an impact on Singapore's urban governance approach, five stood out:

Rule 1: Lead with Vision and Pragmatism
Leadership has an important impact on planning and implementation. One important aspect of leadership is having the political will to push through policies or projects that are considered unpopular or politically difficult if leaders are convinced that such policies or projects are for the long-term benefit of the city. Although they may have a long-term vision, pragmatic leaders are able to focus on what needs to be done immediately, or what can feasibly be done, rather than adhering to ideological principles for their own sake.

Rule 2: Build a Culture of Integrity
Public sector culture is values and beliefs that affect how civil servants, public officers and politicians execute their responsibilities as well as the legitimacy gained amongst its citizens. Accountability, too, is of equal importance. Governments must ensure that sound financing mechanisms are in place to maintain fiscal solvency and, hence, the sustainability of projects. Formal structures to defend against corruption include systems that are transparent, high disclosure requirements, and severe and public punishments.

Rule 3: Cultivate Sound Institutions
Institutional rules and norms, both formal and informal, enable government agencies to work effectively together, irrespective of different (or competing) interests or professional opinions. These institutions include clear and transparent policies as well as incentive structures. The formal institutions can be simple or complex, fixed or adaptive – the variety of forms have been captured in the CLC urban systems studies in areas such as housing, transport and infrastructure, with milestones of the key institutional changes that are needed to cope with the changing policy context.

Aside from these formal institutions, what is more difficult to build, describe, and thus to transplant, are informal institutions – norms of governance such as rational approach to policy, respect for sound professional competence, anti-corruption, meritocracy, and a culture of integrity. The separation of politics and the professional services as embodied in Singapore's institutions is also a significant factor.

Rule 4: Involve the Community as Stakeholders
Creating a liveable city is a huge and complex undertaking and city planners need the support of the city's inhabitants. The government engages the community by creating avenues for participation in the policy-forming processes or in various projects. Even though policy and planning decisions are fundamentally undertaken by the government, the government has increasingly engaged the public on various initiatives to build up the legitimacy of decision-making and the policy outcomes.

Rule 5: Work with Markets
A key governance approach has been to harness market forces where they would improve efficiency. This is a matter of fiscal prudence, and the government has successfully privatised telecommunications, power generation, and some parts of public transport. At the same time, there are limits to private sector provision. For example, the Government has not privatised water provision and the majority of health care continues to be provided by the public sector. The role of the private sector therefore is called into service for, and calibrated against, the overall public role of Government.

Conclusion

As outlined, the CLC Framework derives from Singapore's urban development experience and is not meant to be exhaustive, but is a useful guide for developing sustainable and liveable cities.

The urban systems described in the Framework are of most relevance to cities that are densely populated with limited natural resources. These general principles for building an effective integrated master planning and development process, and a dynamic urban governance system are worth a look by any city interested in raising and sustaining their liveability standards.

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He was the Chief Executive, Board Member of PUB from Dec 2003 to 2011. He was the Chief Executive Officer/Chief Planner from 1992 to 1996 at Urban Redevelopment Authority. He headed PSA Corporation as its Chief Executive Officer/Group President between 1996 and 2002, and Mapletree Investments as its President and Chief Executive Officer from 2002 to 2003. He was the Managing Director (Special Projects) of Temasek Holdings in 2003.

Mr Khoo graduated with First Class Honours in Civil Engineering from Monash University, Australia in 1975. A President-cum-Colombo Plan Scholar, he also holds a Master of Science in Construction Engineering and a Master of Business Administration from the National University of Singapore.

By Jeremy B. Bentham

FUTURE CITIES
in a Resource Constrained World

The world's fast-growing population is urbanising rapidly. As such, over the forthcoming decades, population growth and the resulting increase in energy use will likely be focused in cities, creating both challenges and opportunities.

Challenges associated with rapid urban growth include resource pressures on energy and water supply, as well as the diminishing ability of the natural environment to absorb human-induced pollution and waste. Conversely, opportunities arise from a city's ability to quickly and effectively aggregate business model changes, and the capacity to impact maximum numbers of people with targeted and smart levels of investment.

Much has been written about the rapid growth of cities in recent years. Of note, a joint analysis by Shell and Booz & Company, entitled *Future Cities in a Resource Constrained World*, examines various scenarios that cities of the future might experience. It is upon this analysis that this article is based.

A Changing World and the Importance Of Cities

The world's population is projected to grow to nine billion by 2050. By then, approximately 75% of people will be living in cities, compared with today's 50%. Energy use will therefore concentrate in cities, increasing from 66% of the world's energy use today, to nearly 80% in 2040. Emissions associated with this increase will also grow in the forthcoming decades.

Today, there are approximately 600 cities with a population greater than 750,000 people. However, the average city population is far greater than this figure, standing at 2.5 million. There are currently 21 megacities with populations exceeding 10 million residents. By 2025, the average population in cities will be three million, and there will be 29 megacities worldwide. Geographically, the greatest growth in urban population will occur in China, India, the United States, Nigeria, Bangladesh and Brazil.

It is also worth noting that the growth of resource use in cities is set to increase at a rate greater than population. This is due to the impact of increasing prosperity, which drives energy use per person.

Cities are important, not only for the number of people they house and the resources they require, but because their scale has the potential to make them effective places within which to address issues of resource constraints. Increasingly, essential services – including water, energy, air and waste management – are being addressed at the city level, rather than at national or regional level. Currently, cities impose their own policies and regulations regarding social, environmental and economic development. They are responsible for developing infrastructure and mitigating the effects of pollution, power and water shortages, and climate change-related weather events.

A prime example of a city that takes ownership of all of the above areas is the Danish city of Copenhagen. Since 2011, the city has committed to purchasing only electric and hydrogen-electric cars for municipal use. It aims to become the first carbon-neutral capital in the world by 2025.

> **Energy usage in cities is dictated by a number of drivers. These include climatic conditions, economic activity, geography, income disparities, population and urban design.**
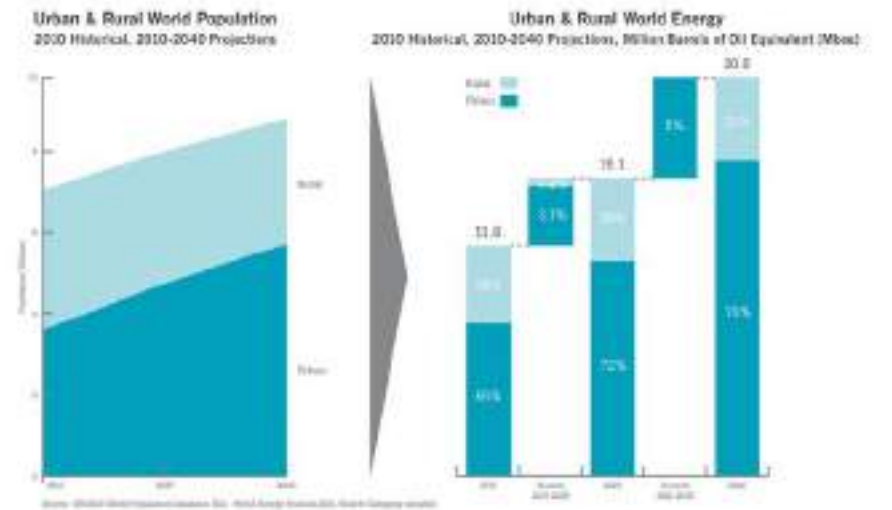

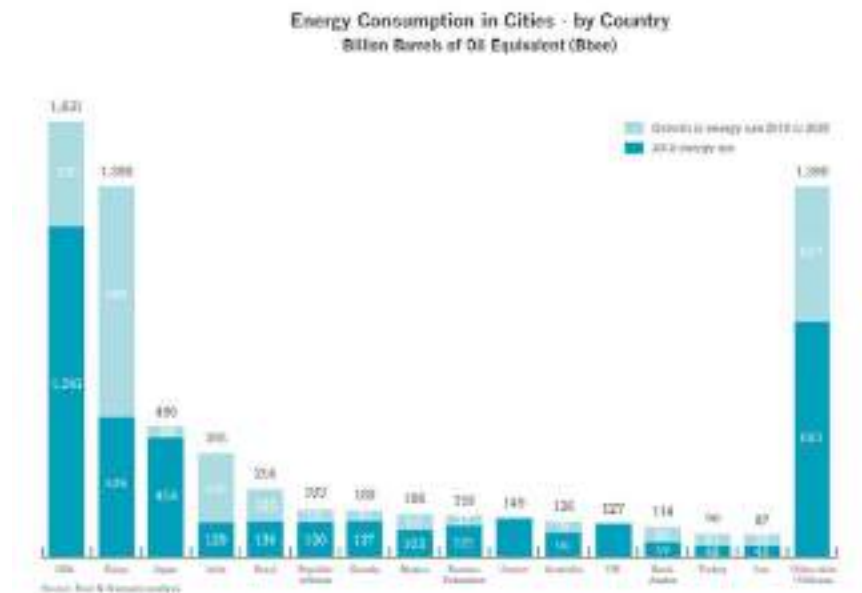Exhibit 1: Global population and energy consumption growth forecasts

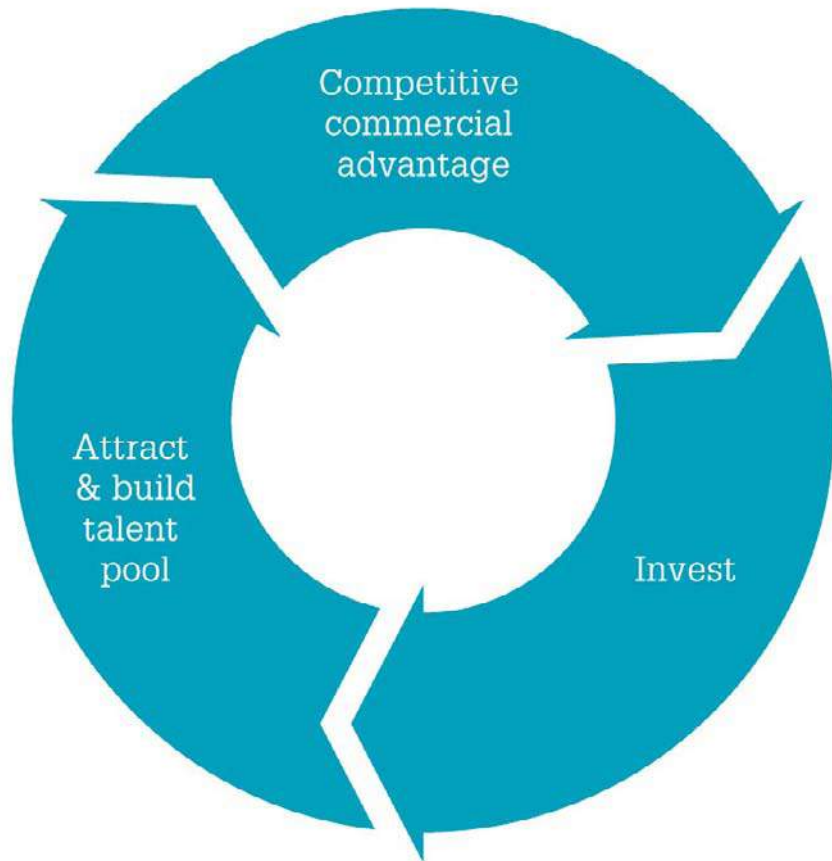Exhibit 2: Energy use in cities with over 750,000 inhabitants by country

Exhibit 3: The City Growth Virtuous Cycle

ADVANTAGE

Early sources of **advantage**:
- Trade hubs
- Cluster of expertise
- Special economic zones
- Ongoing development of commercial advantage resulting from virtuous cycle

INVESTMENT

Companies invest to capitalise on these advantages:
- Expanding production
- More efficient technology
- New products service industries

Government invest infrastructure, enabling more **efficient business** operations and improving **amenity**:
- Transport, services, amenities, communications, education

ATTRACT TALENT

- Jobs and wealth opportunities **attract labour** from outside the city - increasing labour pool and size of home market
- Increasing **education** and up-skilling build **talent** and **entrepreneurism**
- Increased opportunities for skilled people to **network** boosts **innovation**

Drivers of City Development

Cities grow through a cycle incorporating three steps, as illustrated above.

City development begins with a city's competitive advantage. This can include the presence of a trading hub due to geographical location, a gathering of specific expertise, or the presence of policies that promote and regulate economic development.

In turn, investment capitalises on this competitive advantage. Private investment from companies expands trade and production, improves the efficiency of operations, and

develops new products and services. At the same time, public investment in infrastructure is necessary to facilitate efficient business growth and improve the liveability of the city. Public investment includes transport infrastructure, services such as water and waste management, amenities including parks and facilities, and educational institutions.

The resulting jobs and amenities attract, educate and retain labour within the city and grow the talent pool of the home market for resident companies. An increase in opportunities for people to network, additionally, boosts innovation.

The cycle repeats itself, with companies, entrepreneurs and the city government continuing to develop the city's commercial advantages. As a result of further investment, and an increase of skills and talent, the city's GDP grows, accompanied by more amenities and opportunities for individuals.

However, growth can slow or even reverse for a number of reasons. As cities grow to a significant size, marginal diseconomies – such as pollution, crime and congestion – can begin to outweigh the benefits of all of the above. In other instances, a city's competitive advantage may erode as industries

that once made them great begin to decline under open market competition, or, investment by the government or private firms simply ceases. When these occur, a city's growth cycle will either slow, stop or reverse.

Drivers of Energy Usage In Cities

Energy usage in cities is dictated by a number of factors. These include climatic conditions, economic activity, geography, income disparities, population and urban design.

Of note, other things being equal, cities with large populations generally use more energy than those housing fewer people. Likewise, cities that are economically prosperous use more energy than those in decline. In a city that is booming, people use more energy through increased ownership of vehicles, the control of indoor temperatures (through air-conditioning or heating), and greater usage of appliances.

In addition, different city layouts drive different levels of energy usage. According to a joint study published in 2010 by the World Wildlife Fund and Booz & Company, called *Reinventing the City*, energy use in cities with suburban sprawl is much higher on a per capita basis than cities with greater density. This is due to a combination of greater transportation needs and higher household usage driven by larger properties.

This combination of factors driving energy use creates six city archetypes. These vary from prosperous communities, sprawling metropolises and developing mega-hubs (such as Amsterdam, Houston and Buenos Aires, respectively) that are low-density; underdeveloped urban centres (such as Marrakech and Panama City) that are medium-density; and, urban powerhouses and underprivileged crowded
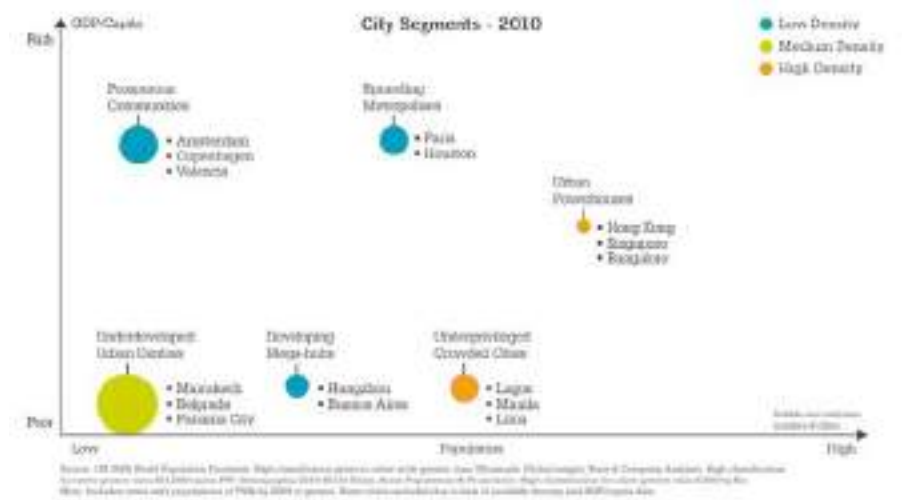

Exhibit 4: City archetypes based on energy usage (and examples)

cities (such as Hong Kong and Lagos, respectively) that are high-density. This is demonstrated by the chart in Exhibit 4.

Currently, absolute energy usage is concentrated in two of these city archetypes, sprawling metropolises and prosperous communities. These include relatively low-density cities with high GDP per capita, typically in the United States and Europe.

Development Pathways

In addition to the above archetypes, six pathways have been identified that allow cities to develop from one archetype to another. For cities with high GDP per capita, the pathways include urban decline, where sprawling metropolises become prosperous communities, and the transition to mega-city, where sprawling metropolises grow even further. For cities with low GDP per capita, there are four pathways with which to develop. These include industrialisation and modernisation, controlled urbanisation, slum proliferation, and late stage growth. This is demonstrated in Exhibit 5 below.
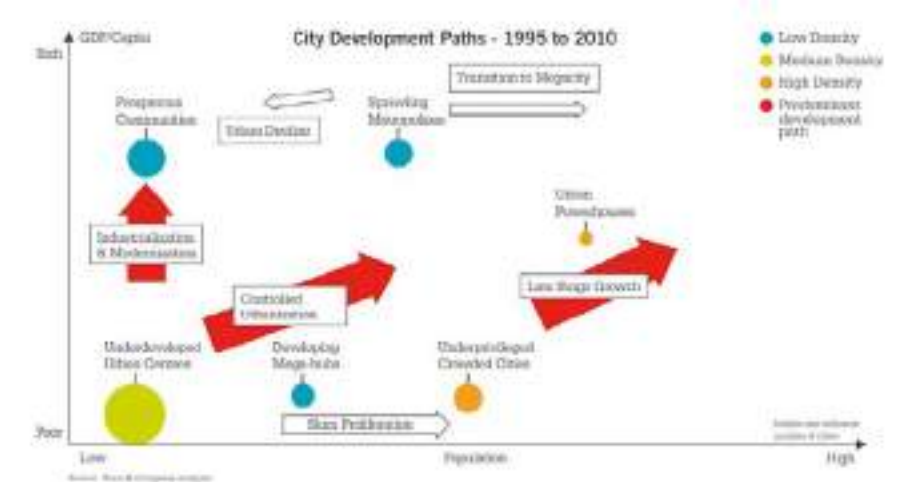

Exhibit 5: City development pathways

Over the forthcoming decades, three pathways will dominate world city growth, particularly in the emerging markets: industrialisation and modernisation, controlled urbanisation and late stage growth.

From an absolute energy use growth perspective, late stage development and controlled urbanisation, driven by a combination of consumption per capita growth and population growth, are expected to dominate over the next 15 years.

The Urban World In 2025

By 2025, the number of urban powerhouses will more than double, with 14 new powerhouses emerging as major cities due to India and China becoming wealthier. Consequently, total energy use in this city archetype will, accordingly, increase.

By this time, there will be fewer underprivileged, crowded, cities in the world – a total of about 30 – as cities across Asia grow wealthier and become urban powerhouses. Yet, there are expected to be more sprawling metropolises – about 50 cities by 2025 – as some cities grow wealthier without creating policy conditions to promote urban densification.

The number of prosperous communities is, too, expected to increase from 127 to approximately 150, as smaller local cities, predominantly in

> " Cities are important, not only for the number of people they house and the resources they require, but because their scale has the potential to make them effective places within which to address issues of resource constraints. "

Asia, become richer. However, it is difficult to forecast the total number of underdeveloped urban centres by 2025, as cities continue to develop rapidly and unpredictably in emerging nations.

Stresses On Cities

Cities around the world face a plethora of stresses, many of which relate to their particular climate, geography and economic status. However, there are a number of universal issues that all cities will face.

In both the short and long term, end-user energy prices will prove problematic to cities of all kinds across the globe. Prices will increase due to a range of factors, including higher demand, fiscal restructuring, emissions pricing, renewable portfolio standards, and increasing commodity fuel costs. Adding to these fundamental drivers of price are volatility and uncertainty around fuel costs, weather, and emissions legislation.

In a number of developing nations, energy price rises are borne by the government, which subsidises energy – an exponentially increasing burden as prices, population and demand per person all rise. Ending such subsidies will prove challenging for emerging market governments and could result in civil unrest.

Cities also face the universal problem of attracting adequate infrastructure investment. With increased loads, increasing peaks of usage, and greater weather extremes, infrastructure assets are under growing pressure. Cities with infrastructure established in the 1960s and 1970s – or earlier – have assets that are at the end of their design lives, at a time when the ability to pay for replacements is low and the disruption impact of replacing an asset being used at capacity is high.

In developing cities with limited financial resources, finding new ways to pay for the vital assets necessary for ongoing economic development in a time of global economic slowdown is a major challenge.

An additional challenge the cities of tomorrow face is that of public amenity. With wealth comes greater public expectation, in terms of liveability. This is partially served through increasing environmental standards and resident's requirements for more technically advanced solutions, which come at a cost premium. For example, low-carbon power is more expensive than coal-generated power, yet many cities choose the former.

In wealthy cities, there is much opposition to infrastructure projects that paradoxically enhance general living - such as roads, wind farms, and sewage treatment plants - yet directly affect surrounding residents, visually and in terms of noise pollution.

Some cities will also need to address the impact of climate change on water supply. This applies to developed cities as much as it does to those from emerging nations.

The world's cities are increasingly becoming the epicentre of human living. How city leaders manage their energy resources will become ever critical in enabling economic and social growth, as well as environmental preservation. With city populations set to double over the forthcoming decades, resources will be stretched to breaking point. How today's policymakers plan for this will be key to the successes – or failures – of tomorrow's cities.

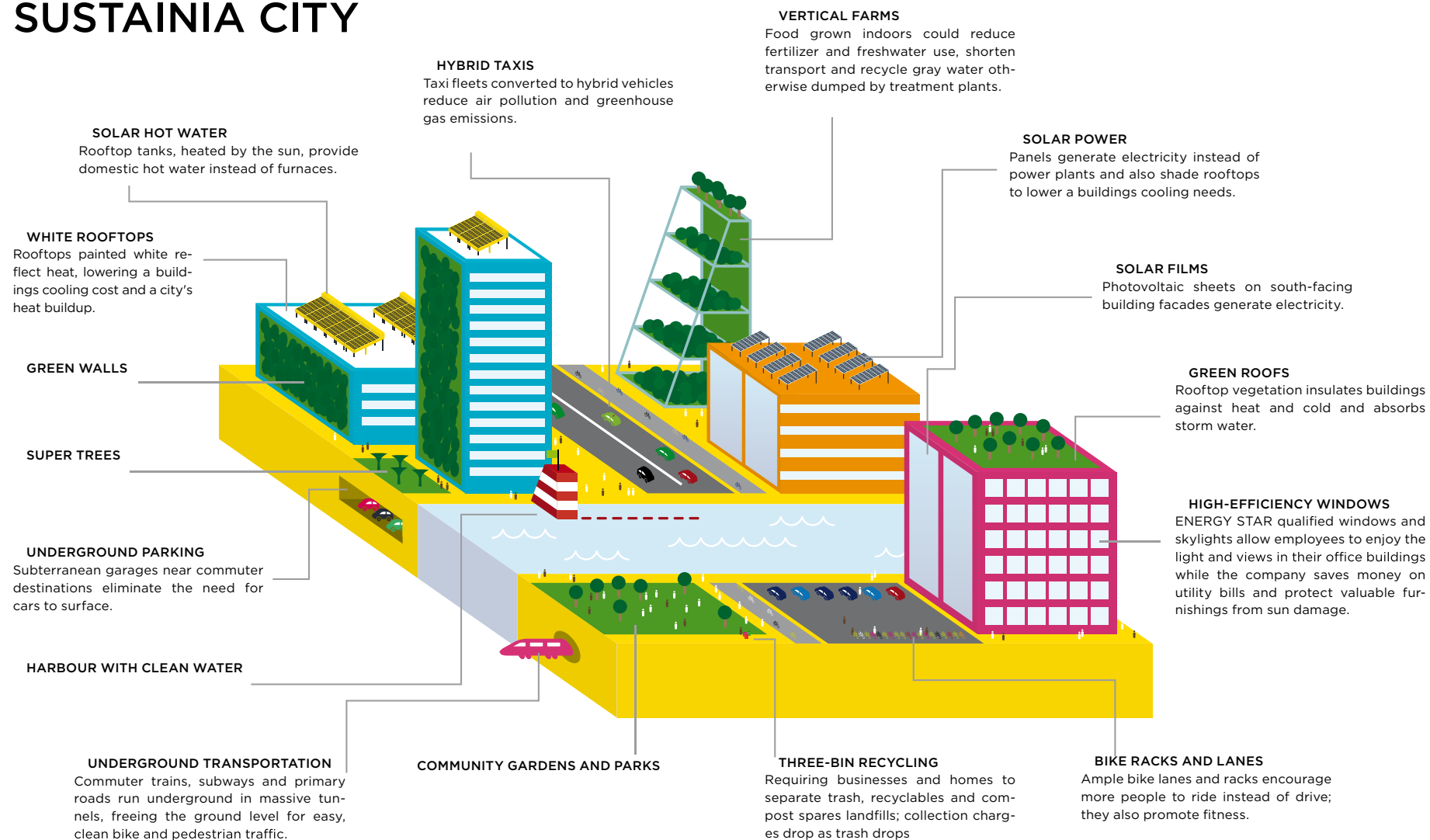*For more information, please visit* www.shell.com/scenarios

Jeremy B. Bentham has been in the energy business for more than 30 years. He is a graduate of Oxford University, where he read physics. He joined Shell in 1980 following post-graduate experience at the California Institute of Technology. He also holds a masters degree in management from the Massachusetts Institute of Technology, where he was a Sloan Fellow from 1990 to 1991. Since January 2006, he has been responsible for Shell's Global Business Environment team, which is best known for developing forward-looking scenarios to support strategic thinking and direction-setting.

By Flemming Borreskov

SUSTAINIA:
The Sustainable Society of Tomorrow

Sustainability has, for too long, been about constraints. It has been about the things we must forego in order to avoid destroying our fragile planet, but imagine if this stigma could change. Could sustainable living become desirable and worth striving for, not because of moral obligations or fear of the future, but because sustainability offers the greatest liveability?

Who Is Behind Sustainia?
- Initiators: Monday Morning, Scandinavia's largest independent think tank
- Founding Partners: DONG Energy, DNV (Det Norske Veritas), Novo Nordisk and Realdania
- Strategic partners: UN Global Compact, R20 — Regions for Climate Action and IFHP – International Federation for Housing and Planning

Welcome to Sustainia

The Sustainia project does just this. It presents a clear vision of what a sustainable future is, and how its citizens – 'Sustainians' – lead better lives than that of our own. In the *Guide to Sustainia*, gone is the 'doom and gloom' approach to preaching about sustainability against the backdrop of Earth's demise. Instead, Sustainia offers a positive vision of a sustainable society that could be realised as early as 2020.

What is Sustainia?

The Sustainia project is a platform that allows a global community of civil society, businesses and experts to collaborate in developing sustainable technologies and solutions, as well as motivate and inspire decision-makers and ordinary people. It aims to motivate decision-makers by showing online the sustainable society that could be built if different sectors, companies, scientists, politicians and civil society worked towards a common goal.

Sustainia addresses efficiency and environmental improvements in four areas: cities, homes, energy and transportation, and offers insight into how individuals can become involved. Some will argue that many of Sustainia's concepts are unrealistic, but all of the solutions introduced are based on today's technologies. These concepts draw on tangible forms of intelligence supplied by authoritative sources, such as leading universities, think tank organisations and multinational corporations. Sustainia maintains that a sustainable society is within reach, and that it is a matter of implementing and disseminating solutions already at hand.

Building Sustainia

Essential to the success of Sustainia is collaboration. Sustainia's vision was created in close collaboration with corporations, organisations

SUSTAINIA CITY

HYBRID TAXIS
Taxi fleets converted to hybrid vehicles reduce air pollution and greenhouse gas emissions.

VERTICAL FARMS
Food grown indoors could reduce fertilizer and freshwater use, shorten transport and recycle gray water otherwise dumped by treatment plants.

SOLAR HOT WATER
Rooftop tanks, heated by the sun, provide domestic hot water instead of furnaces.

SOLAR POWER
Panels generate electricity instead of power plants and also shade rooftops to lower a buildings cooling needs.

WHITE ROOFTOPS
Rooftops painted white reflect heat, lowering a buildings cooling cost and a city's heat buildup.

SOLAR FILMS
Photovoltaic sheets on south-facing building facades generate electricity.

GREEN WALLS

GREEN ROOFS
Rooftop vegetation insulates buildings against heat and cold and absorbs storm water.

SUPER TREES

HIGH-EFFICIENCY WINDOWS
ENERGY STAR qualified windows and skylights allow employees to enjoy the light and views in their office buildings while the company saves money on utility bills and protect valuable furnishings from sun damage.

UNDERGROUND PARKING
Subterranean garages near commuter destinations eliminate the need for cars to surface.

HARBOUR WITH CLEAN WATER

UNDERGROUND TRANSPORTATION
Commuter trains, subways and primary roads run underground in massive tunnels, freeing the ground level for easy, clean bike and pedestrian traffic.

COMMUNITY GARDENS AND PARKS

THREE-BIN RECYCLING
Requiring businesses and homes to separate trash, recyclables and compost spares landfills; collection charges drop as trash drops

BIKE RACKS AND LANES
Ample bike lanes and racks encourage more people to ride instead of drive; they also promote fitness.

(This illustration is inspired by: Scientific American, September 2011)

and experts. With the addition of international organisations and political leaders – such as the UN Global Compact and Arnold Schwarzenegger, Honorary Chair of the Sustainia Committee – the movement houses a team dedicated to enabling action, rather than merely talking about it.

As a result, Sustainia is the 'go-to' place for those with sustainable solutions and the motivation and desire to take action.

However, for change to happen, communication with decision makers and leaders alone is not enough. Sustainia has the potential to engage a far wider audience. Recent developments, such as the Arab Spring, highlight the importance of online communities as drivers of change. Social media and online activities are at the heart of building global awareness of Sustainia.

Destination Sustainia 2020

The consistent failure of the United Nations to implement breakthrough actions in order to mitigate climate change is a painful reminder that political negotiations on this topic are moving too slowly. Politicians alone cannot solve sustainability problems, nor is there a quick fix to the challenges faced by the global community. All sectors must be engaged and, for this to happen, a common goal is needed and Sustainia could become that catalyst to achieve a sustainable society by 2020.

People are often confused about sustainability and what a sustainable future looks like. This confusion limits the scope for tangible achievement. Sustainia eliminates confusion by relating its vision and values in an open and inviting way. People need to be able to relate to sustainability and grasp it to equate the concept to an improved quality of life. It is only through a clear, holistic vision and collective effort that sustainability – 'destination Sustainia' – can be reached by 2020.

❶ **pg 70-71: Illustration of a typical city in Sustainia.** Image courtesy of Realdania.

❷ **pg 72-73: Illustration of a typical home in Sustainia.** Image courtesy of Realdania.

VISIT A HOME IN SUSTAINIA

WINDOWS
Maximum daylight and ventilation ensure optimal indoor comfort and minimal energy consumption. In Sustainia, we use windows that allow natural ventilation without a disturbing breeze, and that let in the light while shading us from the glare.

SOLAR PANELS
Rooftop solar panels will provide most, if not all, of the electricity used in your house[70]. Sourcing renewable power onsite, and not from a distant conventional power plant, reduces transmission losses, slashing emissions and preventing the burning of fossil fuels.

INSULATION
The walls are insulated with aerogel, or "frozen smoke" as it is sometimes called, a nano-technological wonder and the world's lightest and best-insulating material due to its molecular structure. It will save energy and money, and help improve the indoor climate. Remembering that a low-energy building uses at least 50% less energy than a standard building[72] underlines the importance of insulation. A growing body of research[73] shows that better energy efficiency in buildings, in particular insulation, is one of the most cost-effective measures to reduce CO2 emissions[74].

GREEN ROOFS/GREEN WALLS/ ROOFTOP GARDENS
Incorporating green walls into a building's design offers a host of benefits: added insulation, reduced stormwater runoff, absorption of pollutants, natural habitat for birds, bees, and butterflies and reduced outside noise.

ENVIRONMENTALLY FRIENDLY PAINT
To reduce indoor air contamination and the spread of allergens, use only environmentally friendly paint. Use of lead paint was responsible for neurological problems and even deaths of many children throughout the last century. Until recently, nearly all paints on the market contained volatile organic compounds (VOCs) – chemicals that evaporate as the paint dries and gives drying paint a chemical smell. Even after these paints have dried, small amounts of VOCs continue to be released for years. These chemicals are known to exacerbate respiratory allergies and are harmful if released to the environment.

In Sustainia, we only use low and zero-VOC paints. This paint does not contain chemicals that can make you sick. It is good for you and the environment. And the price is competitive.

ENVIRONMENTAL LABELS
Like nutrition labels on food, green building labels offer easy-to-understand data and performance metrics for building materials. The labels will become increasingly common for housing products globally.

LED LIGHTS: (INSIDE AND OUTSIDE THE HOUSE)
LED lights, for applications in homes and businesses, became mainstream beginning in 2010. Previous problems in design and distribution were corrected. LED lights started out pricey, but prices came down quickly as the technology improved and manufacturers scaled up production. Consumers also became savvier about accounting for the life-cycle cost of the products they buy, as well as the long-term pay-off of using a more sustainable lighting alternative[71]

SELF-CLEANING PAINT
New options available are photocatalytic paints and other coatings, which actually remove local air pollutants from air in a room or outdoors. These paints or coatings have anti-microbial, de-odorizing, self-cleaning, and anti-pollution properties and a low-VOC formula. The dry paint or coating cleans itself by destroying bacteria and deflecting dirt that might build up on its surface[75].
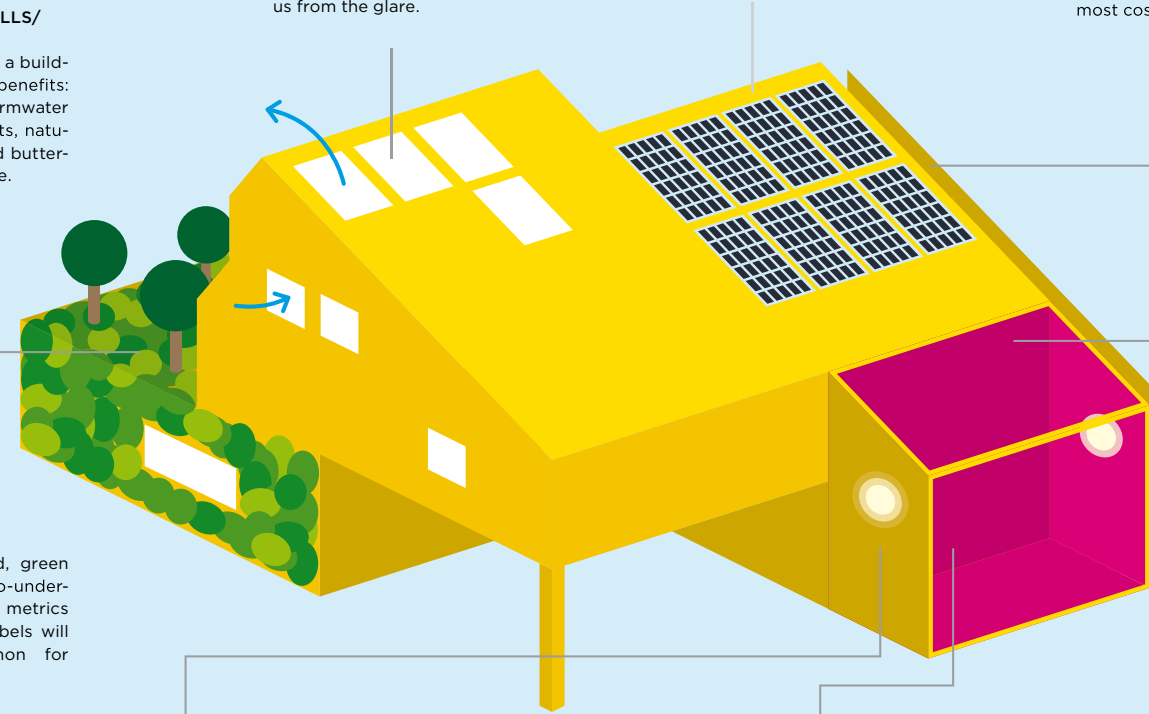
> **City dwellers produce much less carbon dioxide than their suburban counterparts. They live closer, and are more likely to use public transport and many people love living in the city. The cultural diversity and endless possibilities in cities has attracted billions of people in recent decades.**

70 MacKay, D.J.C. 2009. Sustainable Energy - without the hot air.
71 Environmental News Network. www.enn.com
72 www.rockwool.com
73 http://www.rockwool.com/energy+efficiency/the+role+of+insulation/economic+gain
74 http://top10greenbuilding-products.com/2011/greensulate/; http://www.ecovativedesign.com/greensulate/
75 http://www.sciencemag.org/content/331/6018/746.abstract

Cities in Sustainia

The world is entering an age of increasing and rapid urbanisation. Cities today are home to more than half of the world's population. By 2020, the proportion of people living in cities, as compared to residents of non-urban areas, will have increased substantially. Urbanisation, however, is both a challenge and an opportunity.

Cities can champion the low-carbon age as innovative drivers of sustainable economic growth. In Sustainia, cities are retrofitted to improve the quality of life. They are intelligent and employ technologies that enable better energy use, water consumption, transport and communications. Building on best practices for urban renewal and retrofitting, and drawing on lessons learned in new eco-city projects, Sustainia presents what a sustainable city, in the not so distant future, can look like.

How then do cities in Sustainia differ from the cities of today? Firstly, they are built for people, not vehicles. In Sustainia, transport is no longer limited to congested and polluted streets. Rather, Sustainians use walkways, bicycle paths, bus rapid transit, high speed trains and electric cars. These forms of transportation displace and discourage our overuse of oil-dependent automobiles. In Sustainia, engines are not dependent on oil from unstable states, instead, they rely more on batteries fuelled by the sun, the wind and tides, or biofuels derived from non-food sources, such as recycled newsprint.

In Sustainia, people are the key to change. Besides being a sustainable society's greatest economic resource, people add value to cities by bringing their skills, ideas, and diversity. Citizen involvement is vital to the development of Sustainia's cities as research shows engagement and environmental performance to go hand-in-hand. Citizens, thus, are a powerful force to be reckoned with, and can be empowered to be real change-makers.

Principles for Sustainia City include:
- White-painted roofs that diminish "heat island effect"
- Solar water heaters on buildings (heating water uses 17% of energy in buildings)
- Bicycle friendly infrastructure
- Improved energy efficiency in buildings
- Clean waterfronts offering public access
- Attractive and efficient public transportation
- Recycling made easy
- Private and public rooftop gardens
- Parks and/or gardens within a five to seven-minute walk for all residents
- Photovoltaic sheets on south-facing buildings
- Underground parking near transport hubs
- Infrastructure for an increased electric vehicle fleet

Homes in Sustainia

A sustainable home is about ensuring quality of life for its residents – Sustainian homes are smarter, healthier and energy self-sufficient. Existing buildings are retrofitted and new buildings are constructed to support the comfort, health and wellbeing of occupants. Homes in Sustainia incorporate varied sustainable solutions, from rooftop solar panels to smart control systems that give real-time information on energy and water consumption.

Many people today live in unhealthy homes. Common environmental stress factors include overuse of air conditioning, and inadequate lighting and ventilation, which can be detrimental to both physical and mental wellbeing. It is worth noting that indoor air is up to four times more polluted than the air outside. Furthermore, people in the urbanised world spend nine out of every 10 hours indoors.

Homeowners in Sustainia are more than just consumers of electricity and heat. They generate their own energy by means of renewable sources – such as rooftop solar panels – and can sell surplus energy using smart technology.

Therefore, Sustainia's smart home solutions must do two things: reduce energy consumption and make life easier. These solutions allow greater personal control of temperature, water use, lighting and ventilation, and provide real-time information on the energy demands of appliances, and when it is most efficient to use them. They are readily available in many places around the world, and are subject to continuous development.

There are infinite ways to make homes more energy efficient, healthy and intelligent. The *Guide to Sustainia* highlights several of these features, such as smartphone-controlled automatic bath solutions, and 'all off' buttons for home cinemas.

Principles behind Sustainia Homes include:
- Better designed buildings far outperform non-sustainable buildings
- Better lightning improves the endorphins we need to feel happy and content
- Renewable energy technology, such as solar panels or solar water heaters, offer good economic savings
- Better indoor air quality fosters better health and well being
- Increased real-time information on energy and water usage changes consumption behaviour
- Building sustainably is easy and cost effective

From Dream to Reality

A sustainable future might seem impossible and, for many, the obstacles will seem too great to overcome. Sustainia is about breaking down this stigma by envisioning and providing a platform with which to build a better tomorrow. Realising this potential will remain a huge challenge and the size of the task is daunting. However, there must be an awareness of the possibilities at hand, regardless of how much work has actually been done. Sustainia is not a utopian dream; it is a factual vision that is achievable by 2020.

Sustainia draws together solutions and know-how from around the world in order to shape tomorrow's sustainable society. It welcomes front-runners from all sectors – whether they are businesses, organisations, knowledge institutions, government agencies or individuals. It offers a critical mass of best practices and knowledge in one place, with experts capable of bringing greater scale to solutions already created.

As a founding member, I truly believe the Sustainia project will enable change and inspire concrete action. In the words of Antoine de Saint Exupéry, "If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea."

> **We need to make sustainability more tangible to grasp by developing a new narrative and language to communicate about a desirable sustainable future.**

Flemming Borreskov is the CEO of Realdania, a strategic philanthropic foundation based in Denmark, with the objective of initiating and supporting projects that improve the built environment, and subsequently improve the quality of life for the common good. In addition, he is President of the International Federation for Housing and Planning; Vice Chairman of the Danish Architecture Centre; Chairman of the Steering Committee of the Strategic Urban Governance master class programme for Danish urban executives; Green Growth Leaders Founding Father and Councillor; Founding Father of Sustainia; and Member of the World Cities Summit 2012 International Advisory Group.

杨保军

高密度的宜居城市规划探讨

This essay in Chinese is contributed by Yang Baojun. An extract of the essay, which has been translated into English, is found on pages 50–55.

世界上各地区城市密度有较大差异，高中低密度城市分别以东亚、欧洲和北美为典型代表，都有优秀的宜居示范案例。密度对于宜居的影响主要体现在它的空间效率上，受制于该地区资源条件、技术发展、经济能力、历史背景、生活标准、和管理水平等多方面因素，在一定的约束条件下，当高密度模式体现为提高空间效率，则有利于宜居，反之亦然。在目前条件下，东亚地区普遍选择高密度的城市模型是复合地区综合条件的必然选择。本文重点分析了密度因素对宜居性产生影响的途径，同时为东亚地区在高密度模型中，通过不断改善软、硬两方面条件，达到宜居目标，提出了建议。

1. 全球各国城市的密度差异现象及其原因

全球各国城市的形态千差万别，以密度指标衡量，可分为高密度城市、中密度城市和高密度城市。

1.1高密度城市以东亚城市为代表

根据www.citymayors.com网站对人口密度最高的前125座城市的排名，前10个城市中，8个在亚洲，密度最高的孟买密度达到29650人/平方公里，排第10的上海达13400人/平方公里；前30个城市中，21个在亚洲，密度都在8200人/平方公里以上。

从历史发展角度看，东亚、南亚、东南亚长期以来人多地少，城市人口稠密，资源环境压力大。早在工业革命之前，就已经呈现较高密度的特征。为适应人口的高度密集，人们不得不采用种种手段高效利用土地，建造技术、工程技术也在这一过程中不断发展。

大部分城市在发展的初期，其空间拓展是一种"自下而上"的"自构"行为，为应对人地矛盾，城市居民"发明"了多种技术方法，例如建筑层面的多层建筑、吊脚楼建筑、山地建筑等，在垂直方向获取更多的生存空间。

但是在工业革命之后，随着城市规模扩大、城市问题越来越复杂，城市政府必须有所作为，通过"自上而下"的手段，大规模建设基础设施，为"立体城市"建设提供必要的基础条件，同时控制和引导居民的建设取向，从城市演进的角度看，这是一种"被构"行为。为应对愈演愈烈的人地矛盾，这些城市在规划管理、空间布局、设施支撑、建造技术等层面都积累了丰富的经验。

1.2 中密度城市以欧洲城市为代表

欧洲密度最高的城市圣彼得堡列世界第26位。密度排31到100的城市中，欧洲城市占30座，数量最多，密度在7700人/平方公里到2550人/平方公里之间。

从历史发展角度看，欧洲城市的格局大部分形成于工业革命之前，保留了马车时代的城市尺度和街区网格，工业革命之后，机动化对城市格局的冲击有限，城市建筑高度在原有格局的基础上适当加高，因此形成了中密度的城市形态。

1.3低密度城市以北美城市为代表

北美进入前100的只有洛杉矶（第90）和多伦多（第97）。上榜的其它13座北美主要大都市密度都在2350人/平方公里到1550人/平方公里之间，在125座城市中排较后的位置。

北美国家国土资源极为丰富，人口密度小，城市格局基本形成于

工业革命之后，而且推崇以效率和自由为核心的工业文明价值观，形成了以机动车为主导的低密度蔓延的城市形态。由于长期以来美国对全球资源的控制，这种发展模式在过去较长的时间段内得到了延续。

2.城市密度的发展趋势

在资源可以无穷获取的假设下，北美城市的发展模式是大多数人的第一选择，但问题是这种假设是不成立的。随着全球人口的不断增长和工业化的不断加快，全球资源、环境受到了空前的威胁。尤其是土地资源、能源、水资源和生态资源成为束缚增长的瓶颈，（例如：上世纪80、90年代的环境危机、能源危机等等）。在这样的背景下，国际上提出了可持续发展的理念、后工业文明的理念、低碳生态的理念，适度高密度的城市发展已逐渐成为全球城市发展的必然选择。

在北美，由于化石燃料价格上涨，以及人们对城市生活的回归，一种从郊区返回城市的趋向也逐步增长，欧洲城市那种中等密度，广场、街道等公共空间得到良好组织和积极利用的模式受到推崇。北美的城市由于其空间格局已基本形成，因此刚性固化、改造的代价巨大，竞争力下降；与之相反，欧洲城市的空间格局是与适度高密度发展的主流相适应的，因此重新焕发活力，竞争力加强。

3.对高密度与宜居性的认识

3.1对密度的理解
（1）密度的定义
"城市密度"通常可以从"城市集聚要素"或"城市活动密度"等方面加以理解。

所谓城市集聚要素，通常包括人口、建筑密度等，这种定义方式的优点是易于统计和比较，缺点是通常只反映了静态的情况。

所谓城市活动密度，通常包括经济和信息密度等，它是是前者的有益补充，这种方式在反映城市实际运行状态方面具有优势，但缺点是数据不易掌握，往往由于统计口径的差异导致难以进行准确的国际化比较。

（2）密度与城市发展历程的关系
密度是城市集聚的体现，在城市发展的初期，城市集聚能够产生正效益，促使城市规模快速扩大，城市密度也快速提升；当城市发展步入稳步发展阶段，城市规模增速放缓，从追求量的增长转向追求质的提升，城市密度仍然增长，但负面问题开始出现；当城市发展步入成熟发展阶段，城市过高密度导致的环境、交通问题进一步凸显，已产生较大的负效益，抵消了城市集聚的正效益，城市进一步集聚已无动力，从集聚转变为扩散，新城建设开始出现，这种情况下，老城区的城市密度仍然保持在相对较高的水平。

（3）密度与技术的关系
城市密度在一定的历史条件下不能超过一定限度，这个密度以当时条件下的建筑技术水平、工程技术水平、交通工具、经济实力等因素为瓶颈。从人类城市发展的历史看，科学技术的提升能够提高这限度，例如高层建筑技术、新型能源的使用、新型环保技术等等。

（4）密度与资源环境的关系
资源环境（水资源、能源等）是城市正常运行的基础，是影响城市容量的刚性约束条件，也是科学技术较难逾越的障碍，因此城市密度应以资源环境为前提，不能超出资源环境的承载能力。

（5）密度与规划控制引导相关
城市密度是城市规划管理部门对城市建设控制引导的重要指标，

是对资源承载能力、设施支撑体系、三维空间景观等要素综合分析之后的判定结果。在城市发展到一定阶段后，必须通过"自上而下"的城市规划设计与城市规划管理综合分析与控制城市密度。

3.2对"高密度"与"宜居性"关系的认识
（1）"高密度"并不意味着"不宜居"
人们也许会认为，"低密度"意味着优美的自然环境，必然是"宜居"的，相反，"高密度"意味着拥挤、嘈杂、环境恶化，必然是"不宜居"的。

但事实并非如此，因为"宜居性"是一个综合的概念。一方面，它需要优美的自然环境，另一方面，它也需要充足的就业机会、便捷的生活设施、和谐的社会关系等等。而"高密度"对"宜居性"会同时产生正面和负面作用，具体如下：

正面作用：在集聚产生效率的阶段，高密度能够使经济运行效率提高，例如：密度较高的城市采用大运量快速捷运系统，提高了运输效率；能够提供充足的就业岗位；易于支撑繁荣的商业活动；为市民提供了多样化的生活方式；能够增加人们相互间交流的机遇从而激发创新活动等。

负面作用：例如环境质量降低，设施支撑能力不足，交通拥堵等。

从正面作用看，"高密度"相对于"低密度"是更具备"宜居性"的；从负面作用看，虽然"高密度"确实有可能伴随"不宜居"，但这些问题完全有可能通过技术、规划、管理等途径得到妥善解决，并不是无法避免的。

（2）高密度城市的选择符合东亚地区的客观资源环境条件
相对于其它地区，东亚地区更加严峻的人均资源约束，使高密度城市发展模式成为必然选择。高密度模式以较少的人均可开发土地容纳了更多的城市人口，从而有条件将节约的土地从事农业生

产，以养活庞大的人口；以及用于森林、湿地等生态保育功能，为地区生态环境的保护提供基本保障。

（3）高密度城市在全球面临资源环境枯竭的背景下更具备空间竞争力
全球人口的爆炸式增长和资源环境的枯竭是短时期内无法遏制的趋势。

在达到同等城市服务水平情况下，高密度城市通过发挥规划效应，提高城市运行效率，有利于降低水、能源等人均资源消耗量，从而符合可持续发展的基本原则。同时，高密度城市易于促进和维持更大规模和强度的经济活动，甚至激发更高层次的社会需求，在世界经济发展需求不足的大背景下，对促进经济繁荣有一定正面影响。

因此，可以断定，在资源稀缺的宏观条件下，高密度城市具备更高的空间竞争力。

（4）城市密度的多样化符合人对多样性的需求
高密度城市并不是指城市的所有地区都保持在一个密度，而是强调在内部也存在差异性，实现"疏密有致"。从城市社会生态角度考虑，不同密度的地区容纳了更多元化的人和社会活动，更容易促成城市多样性的发展，推进更高层次社会文明的发展。

（5）中国当前的主要差距：城市管理能力等软件方面的差距
中国通过30年的高速发展，在建造技术、工程技术等硬件方面水平已与发达国家接近，但随着城市发展问题日趋复杂，一些城市在规划与管理方面滞后，导致大量重复建设或无效建设，造成经济、社会、环境效益的巨大损失；大量的建成设施未得到高效利用，造成有限资源的低效率使用。整体上讲，中国城市建设的决策水平、城市资源的管理水平亟待提高。

4. 高密度条件下实现城市宜居性的对策

如前所述，高密度城市完全可以通过技术创新、科学规划、科学管理规避其负面作用，实现更高生活质量的宜居城市。新加坡、香港、东京等城市为东亚其它城市提供了良好的启示。借鉴这些高密度城市发展的成功案例，可将高密度条件下实现城市宜居性的对策分为以下两个方面：

4.1规划理念与策略方面

（1）绿色开敞区域与紧凑高效城市相融合

为实现土地的高效使用，首先应遵循的理念就是"优地优用、劣地少用"。因为不同土地的"可使用性"依循其区位条件、资源禀赋、发展阶段等属性，相互间有很大的差别。如果采用均质的使用方式，一方面削弱了可高强度使用土地的发展潜力，另一方面又无法发挥不适宜建设土地的自然环境调适能力，因此从经济、社会、环境的综合效益来看，必然是低效的。相反，"优地优用、劣地少用"，能够将各自的优势充分发挥，使得综合效益达到最高。

"优地优用、劣地少用"落实到城市规划与建设，就是首先保障绿色开敞区域，严格控制农田、生态保育区等非城市开发地区的建设行为，恢复并逐步改善其生态与必要的休闲功能，形成高密度城市赖以生存发展的宏观生态背景；其次是建设紧凑高效城市，以完备的公共设施、基础设施、高密度的建设投资和高效的建设管理控制等多种手段为紧凑城市打下基础，达到节约土地资源、提高城市运行效率和经济效率的目的。

为避免城市无序蔓延，应首先确定城市远景空间结构，在该结构中明确建设与非建设地带，准确划定城市发展的边界（Urban Growth Boundary），以具有法律约束力的规划工具，严格控制城市在自由市场状态下的随意蔓延。

案例分析：

香港是这一理念的典型代表。香港的城市开发以高密度著称，但它在城市开发的同时，对非城市建设地区进行了严格的保护，以极高密度的市镇开发容纳了全区人口，至今城市建设用地不足全部土地面积的20%，剩下的空间仍然保持为林地和农地状态。这样的选择，城市运行是高效率的，例如香港的地铁系统长期以来，一直是世界上唯一能够营利的城市捷运系统；同时，生态环境得到了高水平的保护。

（2）区域生态基质与城市生态斑块相衔接

按照景观生态学的理论，应逐步建立"基质、廊道、斑块"结构完整的自然生态系统，与高密度城市的人工生态系统相辅相成、相得益彰。

在保障绿色开敞区域的基础上，应尽可能地保护城市生态斑块不被破坏，以城市公共绿地、山体、水面等形式点缀在高密度的城市建筑之中，并逐步建立和完善城市生态斑块与区域生态基质之间的生态廊道，形成生物迁徙廊道，并为市民创造休闲、游憩的公共空间。

案例分析：

新加坡是其中的杰出代表。相对于香港，新加坡的城市开发占用了更多土地，但建设区域与非建设区域仍然是泾渭分明的。建设地区与自然保育地区有机的穿插，相邻的自然地块对建设地块提供了有效的生态服务和休闲空间，避免大面积建设地区连片造成城市环境急剧恶化的状况。各建设地区获得相对均等的环境品质，城市如建设于花园中，因此，新加坡的城市环境历来受到人们推崇。

（3）控制合理的城市组团规模

组团是提供基本城市服务的空间单元，同时也是形成城市空间结构的重要组成部分。合理的组团规模是维持基本的城市服务与合理的空间结构的必要保障；组团内部的功能均衡，有助于降低组团间的交通需求；同时，控制组团规模，避免组团连片发展，在组团之间设置必要的生态廊道，

有助于改善城市小气候条件，形成健康的生态环境。

当城市规模扩张到一定阶段，就会从集聚经济走向集聚不经济，到达此临界点之后，应避免主城规模继续扩大，转而推进跳跃原有老城区的新城、新区建设。在新城、新区建设过程中，应特别注意保证合理的组团规模，如果规模过小，将无法产生集聚效应，导致公共设施、基础设施配套不经济，城市运营成本过高。

案例分析：

伦敦为了避免人口向大都市的过度聚集，希望借助周边一系列新城的开发形成反磁力圈，用以疏解中心城人口和吸纳继续涌入伦敦大都市区的人口。其中，第三代新城米尔顿·凯恩斯是其中比较成功的代表。它的成功经验一方面是较好的实现了就业与居住的平衡，实现稳定的人口增长，从1967年成立米尔顿·凯恩斯开发公司，1970年开始建设，到1981年，原有村镇人口从3.5万人增加到12万人。另一方面，它保持了适中的密度，合理的组团规模，从而保证了即能支撑公共服务和商业繁荣，同时较高的环境品质和生活质量。新城占地89平方公里，以方格网系统划分成许多方形街区，又用生态绿廊建设区划分割为规模适宜的组团，即规划了集中的商业和公共中心，又为各组团提供了均衡的基本服务。环绕城镇的是茂密的森林，10多个人工湖点缀其间，风景秀美。

（4）建立"大运量轨道交通+慢行交通"的综合交通系统

城市人流、物流的高度集聚使得大运量公共交通系统的发展成为可能，公交主导的交通方式便于将分散的交通行为组织为更加高效的群体交通行为，高效利用城市空间资源，降低了人均资源消耗和污染物排放。这也是高密度城市优于低密度城市的重要表现。

公交主导的城市开发强调了交通方式与土地利用的结合，强化了城市系统之间的整合，是城市空间资源统筹的更高模式，具有更高的效率。

大运量轨道交通还可以支撑以轨道站点为核心的城市高强度综合开发，集聚人口与经济活动。普遍的做法包括结合轨道交通站点布局城市组团的公共活动和服务中心，轨道站点附近布局"停车换乘"设施和公交换乘枢纽等。

"大运量轨道交通"主要解决远距离的人流运输，而"慢行交通"主要解决近距离的人流运输，它是"大运量轨道交通"的必要补充，解决从轨道交通站点到居住地或就业地"最后一公里"的交通途径。传统的慢行交通系统布局在机动车道的两侧，仍然具有浓重的"以车为本"的色彩。为充分实现"以人为本"，应建立独立于机动车路的、安全便捷的慢行交通系统，满足通勤和游憩功能，保障通行过程的宜人感受。

案例分析：

东京都人口密集，在战后复苏和60年代飞速发展过程中也面临人口过度集中的压力，在这一背景下，多摩新城于1965年开始建设，是东京周边一系列新城中较为成功的案例。新城东西长约14公里，南北宽1到3公里不等，规划人口约34万人，划分为3000到5000户不等的21个居住邻里。每个邻里有两所小学，一所初中，以及比较完善的生活和公共服务设施。几个邻里组合成一个区，每个区的中心设有一个捷运轨道站，通过东京轨道网与东京都中心和其它市镇保持便捷联系。而轨道站与每个邻里以及居住单元的联系通过步行、自行车、公交或私有小汽车完成。多摩中心站周边更是规划为新城的功能中心，集中了商务、商业和娱乐功能。

（5）鼓励城市用地的混合使用

现代主义城市强调的是城市的功能分区，工业用地、居住用地、公共设施用地应有明显的边界。当时的工业用地会产生较大的空气、水、噪声污染，提出功能分区的主要目的是保障居住宜人环境。但是，在步入后工业社会之后，大部分市民的就业场所已不是产生污染的工业厂房，代之以无污染或少污染的商务办公楼、工业楼宇等建筑形式，这为城市用地的混合使用创造了可观条件。

混合使用能够促成在非机动车通勤范围内的职、住、娱平衡，它是对传统城市空间模式和生活模式的一种回归，突出优点是方便日常生活，缓解交通压力与能源消耗，同时利于形成健康而具有活力的城市社区，利于城市经济的繁荣等。

在新城、新区建设中，应特别注重职、住、娱平衡，避免出现就业过多、居住过少的"死城"，或者就业过少、居住过多的"卧城"。

（6）高效的水资源利用、能源利用、废物处理与循环利用系统

资源、能源的有效利用，废水、垃圾、废气等废物收集、处理和循环利用能力是考验城市运行的重要方面，努力提高这些系统的技术、管理水平和运行状态是保证在高密度条件下维持高质量生活的必要条件。

在城市资源利用方面，一般应推进减量化、再使用、再循环的"3R"原则。尽量减少城市资源消耗，即减少外界对城市系统的资源输入；鼓励对资源的重复使用，提高资源利用效率；同时不断探索和发展循环利用技术，鼓励将城市排放、排泄的"废物"资源化，重新输入到城市运行系统中。整个理念视城市为自然的寄居者，通过减少输入和排放，达到减少对自然循环的干扰的目的。

（7）完备的城市综合防灾体系

自然、人为灾害诱发因素繁复杂，努力建立符合城市特点、综合完善的城市安全体系，最大限度的预防灾害和降低灾害损失至关重要。其中，应特别强调灾难预警、交通、通讯、物资储备、避难场所等城市各功能系统的协作与协调。

城市防灾系统是城市的应急备用系统，在无灾害时期仍然要持续的占用城市的各种资源，为了提高城市资源的使用效率，也为了更好的维护这些设施，应在不影响防灾设施效力的前提下，积极鼓励防灾设施的综合利用。例如城市公园与避难场所的合建，交通、通讯设施的公用等。

4.2规划管理与制度方面

（1）完善的法定规划体系

建立完善的规划编制、实施体系，并赋予其法定权威，是科学规划、严格落实的前提。该体系的建立应特别注意各方权利的维护，各种社会资源的充分调动，各种信息的有效沟通，在实施过程中应实现有效监督，对违规行为实现有效约束。

（2）健全的公众参与机制

这是确保规划公正、公平的重要措施。应尽力推动规划编制、实施全过程的公众参与，以此保障市民和各利益攸关方的合法权利，防止腐败，避免重大决策失误。

（3）严格的规划管理与动态维护机制

建立严肃的规划编制、审批、评估和维护机制，使规划得以科学编制，严格执行，并随着情况变化而不断更新、日趋合理，持续发挥效用，成为引导城市有效发展的蓝图和行动纲领。

（4）培养和谐的基层社区组织

应注重社区能力的培养，鼓励先进的社区文化的发展。推进城市基层社会与物质环境的共同、协调发展，让城市天然存在的自下而上的自组织能力与有意识的自上而下的规划管理能力协调运行，使城市获得更加健康的自我修复和更新能力。

5.总结

高密度城市是全球城市发展的趋势，在东亚地区、在中国，更是人地矛盾突出条件下的唯一选择。东亚发达地区的城市建设经验表明，高密度城市并不意味着宜居水平的下降，完全可以通过规划理念与策略方面和规划管理与制度方面水平的提升来提高城市宜居性，同时，发挥高密度城市的集聚优势，实现经济、社会、环境效益的综合提升。

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