

The Science and Art of City-Making

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MHA Phoenix Series

31 July 2025, 2.30 – 4.30pm

Good afternoon, Permanent Secretary Pang Kin Keong, and greetings to the Home Team. Thank you very much for inviting me to speak at your Phoenix Speaker Series. It is a pleasure to share insights on a subject close to my heart. I have lived all my life in high density urban environments, and have spent more than half my lifetime studying cities.

But it is not just about a personal experience. More than half the world's population now lives in cities – over 57%, to be precise. By 2040, it is expected that this will grow to two-thirds. By 2050, the figure is expected to rise to 70%. Governments worldwide need to pay attention to the experience of city living in myriad dimensions.

My talk is focused on urban environments around the world and how they are confronting a convergence of multiple challenges that demand collective wisdom, innovative solutions, and collaborative partnerships. In the face of myriad challenges, the language of sustainable and liveable cities has dominated. But some will argue that these are hackneyed concepts, overused, undertheorised, and overgeneralised. What I would like to offer is another lens and language to think about urban environments – cities as resilient, regenerative and restorative, or, if you like, cities that can bounce back, give back and bring us back to health. In these ways, cities become sustainable and liveable.

I would like to share about how the making of such cities will require both a science and an art. Science and technology play critical roles in the making of resilient, regenerative and restorative cities, but equally important are trust, collaboration and participatory governance. They point to how there is an equal need to balance the technical with social dimensions—the science with the art—of building sustainable, thriving urban environments.

Challenges Confronting Our Cities

Let me begin by outlining the major challenges that confront cities today.

First, **geopolitical instability**: Conflicts and wars disrupt economies and supply chains, and strain the cost of living. They threaten cultural and natural heritage, creating ripple effects across urban economies, urban life and peace of mind.

Second, **climate change**: Coastal regions face existential threats from rising sea levels. The frequency and intensity of extreme heat events has increased. On 22 July 2024, the world experienced its hottest day on record. The built-up environments of cities are especial cause and victim of these changes.

Third, **public health crises**: The global experience with pandemics has underscored the fragility of our planetary systems, especially our urban systems. The looming

threat of an unknown Disease X raises critical questions about urban preparedness and resilience strategies.

Fourth, **technological disruption**: Rapid technological advancements, from artificial intelligence to automation, offer substantial opportunities but also pose significant risks to employment, privacy, and social cohesion.

Fifth, **social fragmentation**: There are increasing social divides and intercommunal tensions, exacerbated in urban areas where people live cheek by jowl. And there is eroding trust in institutions, and between governments and citizens. In the face of these challenges, our task is to ensure that cities find ways to adapt, innovate, promote trust and mutual understanding, and ultimately flourish.

Lastly, **complexity and interdependency**: Cities represent intricate systems, comprising countless interacting components that often defy straightforward analysis and prediction. Effective solutions demand interdisciplinary and integrative approaches, transcending traditional disciplinary silos to understand and manage the interdependencies inherent within urban systems.

The Nature of Resilient, Regenerative and Restorative Cities

Let me turn from the challenges confronting our cities to a vision of cities of the future – cities that can not only withstand disruptions (and are therefore **resilient**) but actively **regenerate** their environments and **restore** their residents' well-being. I will now outline these three interconnected ideas.

Resilient Cities

Urban resilience is about enabling cities to anticipate, prepare for, and respond effectively to disruptions, whether these are sudden shocks or gradual stresses. The aim is to build socially equitable and cohesive urban communities, enabled by affordable housing, diverse economies, and accessible services. Such cities possess two crucial capabilities:

- **Proactive capacities** involve the ability of communities to anticipate adversities and develop strategies to prevent, minimise, or avoid vulnerable circumstances. Such strategies may be anchored in science and technology (polders is an example), but equally, collective action is a form of social technology - harnessed for social good and positive change, effectively preparing for potential challenges before they escalate into crises.
- In parallel, **reactive capabilities** are the community's ability to respond to, recover from, and adapt to adverse situations. This requires technical and technological expertise, as well as a deep understanding of stakeholder networks and their motivations, enabling communities to limit damage from unforeseen events and adjust to evolving conditions effectively.

Resilient cities thus emphasise data-driven approaches, technological advancements, and innovative infrastructure, but also recognise the importance of trust, social cohesion, and community engagement. By integrating science and technology with humanistic and societal perspectives, resilient cities aim to build communities capable of withstanding future challenges, and addressing and overcoming adversities when they arise.

Regenerative Cities

Regenerative cities not only minimise ecological harm but actively enhance the ecosystems they inhabit. They incorporate systems thinking to ensure urban development contributes positively to the environment, replenishing resources faster than they consume them. This involves:

- Adopting circular economy principles that turn waste streams into resources (such as Singapore's extensive water recycling efforts).
- Urban greening initiatives to reverse biodiversity loss and reduce urban heat.
- Policies that incentivise sustainable construction and energy-efficient buildings.

Through these initiatives, regenerative cities rejuvenate urban ecosystems, transforming challenges into opportunities for long-term sustainability and vitality.

Restorative Cities

Finally, beyond physical regeneration lies the equally critical need for urban environments that are restorative—those that prioritise the mental, physical, and emotional well-being of their residents.

Restorative cities, a concept pioneered by scholars Jenny Roe and Layla McCay, deliberately design urban spaces to address environmental stressors such as noise, overcrowding, and sensory overload. They foster recovery from mental fatigue, reduce stress, anxiety, and depression, and enhance overall quality of life. The framework for restorative cities comprises seven attributes, or pillars:

1. **Green City:** Prioritises exposure to natural environments to reduce depression and anxiety while improving brain function
2. **Blue City:** Integrates urban water features to reduce depression, improve mood, and contribute to stress alleviation
3. **Sensory City:** Integrates the use of senses within urban design to positively impact mental health, such as by reducing unpleasant noise and creating positive food auras
4. **Neighborhoodly City:** Builds strong social networks through urban design by creating opportunities for both impromptu and organised social interaction.
5. **Active City:** Integrates physical activity into everyday urban life to enable mobility for all citizens
6. **Playable City:** Nurtures creativity, learning, self-identity, and social interaction across all ages through play.
7. **Inclusive City:** Designs for all ages, genders, races, ethnicities, sexual orientations, socioeconomic strata, and for the full diversity of physical, sensory, and cognitive abilities and needs.

Through these restorative design strategies, cities can profoundly improve human health, societal cohesion, and community resilience—critical for thriving in an increasingly complex urban landscape.

The Science and Art of City-Making

Having outlined the significant challenges confronting urban cities today, and the vision and ideal of resilient, regenerative and restorative cities, let me now turn to how cities can be equipped to not only withstand disruptions, but also actively regenerate and restore themselves.

Science and technology play critical roles in shaping urban landscapes and in resilience-building. Smart technologies, AI-driven analytics, and decarbonisation strategies are some of the proactive capacities that enable cities to develop muscle for efficiency and resilience. Polder technology, pioneered by the Netherlands, exemplifies proactive resilience-building by transforming flood-prone areas into usable land through land reclamation protected by dikes, drainage canals, and pumping stations.

Singapore has embraced similar approaches through pilot studies, notably exploring polder technology at Pulau Tekong as part of its broader efforts to enhance climate resilience. Additionally, the government has committed S\$5 billion to a coastal and flood protection fund, part of a long-term plan to invest S\$100 billion over the next 100 years. Singapore also leads in environmental sustainability by reusing water extensively. These examples illustrate proactive capacity at its best.

However, the ability of cities to be resilient goes beyond technical solutions. It requires strong trust relations, tight social compact, and a strong sense of community. Resilient partnerships across the public, private and people sectors are essential for fostering adaptability and ability to react in the face of crisis.

Herein lies my call for attention to both the science and art of city-making.

The science of cities emphasises data-driven approaches, technological advancements, and innovative infrastructure. It leverages scientific and engineering research and relies on science-based technology to tackle evolving urban challenges effectively.

On the other hand, the art of city-making seeks to understand the social fabric, cultural dynamics, and human experiences that define urban life. It involves deepening residents' sense of belonging, building trust, and promoting community engagement. This approach values diverse perspectives, nurtures creativity, and promotes meaningful connections among residents. It also requires trust relations between leaders and citizens, between public and private sectors, between citizens and private organisations.

To build truly resilient, regenerative and restorative cities, we need to intentionally integrate the science and art of city-making. Relying on technology or infrastructure is insufficient; investment must be made in shoring up social resilience and community cohesion. Only then will we be able to pull together during times of crises with enhanced reactive capabilities.

Let me now take each in turn, beginning with the science of cities.

The Science of Cities: New Tools, Big Data, and Holistic Approaches

To build cities that are resilient, regenerative, and restorative, we must sharpen our understanding of urban systems through rigorous scientific inquiry. Peter Ho, former Head of Civil Service, has been a key advocate of the science of cities. He has underscored the importance of integrating scientific tools, big data analytics, and interdisciplinary approaches in city-making. I recall remarks he made at the World Cities Summit, highlighting the need to move beyond siloed perspectives, embracing a more systemic and adaptive approach to urban challenges.

One of the critical developments in this domain is complexity science, which enables city planners to model and analyse the dynamic interactions between individuals, institutions, and infrastructure. Agent-based modelling, for instance, provides deep insights into urban systems, allowing planners to anticipate vulnerabilities and design more proactive, adaptive strategies.

At the same time, big data and artificial intelligence (AI) transform urban governance. Cities today generate vast amounts of data from residents, institutions, and infrastructure—particularly through Internet of Things (IoT) technologies. The Smart Nation initiative is a leading example of how cities can leverage these data streams. By combining AI, high-performance computing, and data analytics, urban decision-makers can gain real-time insights into emerging challenges, anticipate disruptions, and implement evidence-based resilience and regeneration strategies.

However, while big data enhances precision in urban decision-making, effective city-making demands more than technological sophistication in individual domains such as transport, waste disposal or housing. It requires a holistic, systems-level perspective that recognises the interconnectedness of urban functions. The UK's Foresight Future of Cities project, for instance, exemplifies this approach, integrating perspectives across sectors—transport, infrastructure, agriculture, and social systems—to ensure urban policies are coordinated, sustainable, and equitable. Similarly, our "Whole-of-Government" approach serves as an instructive model for integrating urban resilience, regeneration, and restoration. By aligning efforts across multiple domains—housing, transportation, commerce, healthcare, and public spaces—Singapore ensures that growth, environmental sustainability, and social well-being are pursued in a cohesive and balanced manner. Such an approach underscores how urban resilience is not simply about responding to crises but about fundamentally rethinking the way we design, govern, and inhabit our cities, taking on board regenerative and restorative needs at the same time.

Trust and Participatory Governance

Let me turn now to the art of city-making. I had referred earlier to the question of trust, social compact and participatory governance, emphasising that the focus on the science of cities is necessary but insufficient. Trust between citizens, businesses, and government is the foundation upon which resilient, regenerative and restorative cities are built, for they ensure that policies and technologies withstand the tests of time and crisis.

According to the 2025 Edelman Trust Barometer, trust in the Singapore government remains high, with 66% of Singaporeans expressing confidence, making it the most trusted institution in the country. Trust in other institutions, including NGOs, businesses, and media, also remains relatively high, with Singapore exceeding the global average in overall trust. The report also shows a decline in trust among lower-income groups, underscoring the challenge of trust inequality.

However, globally, there is still greater mistrust of science and government. There is increasing scepticism about scientific findings, concerns about transparency, potential biases, and perceived conflicts of interest. There is also growing mistrust of government institutions, due to fears of corruption, lack of accountability or exclusion of citizen voices in decision-making.

To counter this mistrust, governments will need to adopt more inclusive approaches in their engagement with citizens. Scientific advancements need rigorous evaluation and effective regulation to ensure they are safe and beneficial for all. There needs to be clear and open communication about how these advancements are developed, tested, and implemented.

Businesses are also part of this trust ecosystem. When they demonstrate social and environmental responsibility, they build trust with consumers. If they prioritise profits over safety or exploit loopholes in regulations, they become part of the mistrust problem. Governments, scientists, and businesses must engage in meaningful

dialogue with the public, address concerns and incorporate suggestions. By working together, all parties contribute to a more trustworthy and inclusive climate.

Managing Citizen Voices and Cultural Engagement

Besides trust, effective city-making also involves thoughtfully managing citizen voices and actively promoting community engagement.

Rising Citizen Voices and Resistance to Urban Plans

Cities globally, including Singapore, have witnessed a rise in citizen activism and organised resistance to urban developments. Facilitated by digital technologies, residents today can mobilise rapidly, form cohesive advocacy groups, and amplify their concerns effectively and broadly.

Technology-enabled mobilisation has transformed civic engagement significantly. For example:

- **Online Petitions and Templated Advocacy:** Digital platforms have enabled citizens to quickly mobilise around shared concerns, placing greater pressure on planners and policymakers for transparency and responsiveness. Online petitions can quickly escalate, and repeated forms of pressure through the use of templated letters are now common, giving rise to the concept of templated advocacy.
- **Wider Mobilisation and Politicisation** is also much easier now with technology. Issues can quickly escalate beyond immediate neighbourhoods, drawing attention

from Members of Parliament (MPs), interest groups, and media outlets, complicating urban planning processes and requiring proactive stakeholder engagement.

To navigate these dynamics constructively, city-makers must understand and manage citizen voices thoughtfully and inclusively. Some approaches that have been used effectively include: embedding officers within communities; involving citizens in decisions; encouraging citizen science; and promoting cultural engagement.

- Embedding officers within communities: A practical example of embedding officers within communities is the approach of embedding NParks officers directly within nature advocacy groups. By fostering trusted relationships and facilitating dialogue, this method builds deeper understanding, anticipates community concerns, and enables collaborative rather than adversarial relationships.
- Involving citizens in decision-making: Involving citizens in decision-making builds trust and community ownership. An example of this is the Home Improvement Programme (HIP) managed by the Housing and Development Board (HDB). HIP illustrates proactive urban rejuvenation combined with restorative community outcomes. Public exhibitions and consultations create transparency, empowering residents to participate actively in shaping their living environments. The outcome: improved urban environments and increased resident trust in public authorities, reinforcing resilience at the neighbourhood level.

- Encouraging citizen science: An interesting, complementary dimension to scientific and technological research typically undertaken by academics and institutions is citizen science, which actively engages the public in scientific research. Such citizen science programmes directly support the integration of rigorous scientific inquiry with meaningful community participation, helping to nurture trust, build social cohesion, and foster restorative urban experiences rooted in environmental awareness and stewardship.

NParks' Community in Nature programme exemplifies this approach, involving citizens directly in biodiversity research and conservation initiatives. Through initiatives such as BioBlitz, NParks mobilises volunteers—including residents and school groups—to participate in biodiversity surveys conducted within specific timeframes across Singapore's parks and nature reserves. Participants document local plant and animal species, contributing crucial data for conservation efforts. BioBlitz events provide valuable baseline data, inform conservation strategies, and raise public awareness and appreciation for Singapore's rich biodiversity. Beyond BioBlitz, citizens participate in numerous other biodiversity monitoring initiatives such as bird counts, butterfly surveys, and marine habitat monitoring. By equipping residents with the skills to collect data accurately, NParks empowers communities not only to understand their environment but to contribute actively to its protection and regeneration, strengthening the city's ecological resilience while fostering a sense of stewardship and community pride.

- Promoting cultural engagement: Alongside managing citizen voices, cultural engagement is a critical dimension of city-making, significantly impacting social cohesion, community resilience, and quality of urban life. Active cultural engagement strengthens residents' sense of identity, belonging, and emotional attachment to place. Public art and community events not only enhance urban regeneration but also foster restorative experiences, enriching community life. An example is the Marina Bay "i Light" Festival, where artists create interactive installations that engage residents while highlighting environmental sustainability.

Building 3R cities: two examples

Let me cite two examples of building 3R cities: first, the 15-minute city, very much a local, micro-scale perspective of urban resilience and well-being; second, the robustness of supply chains, which scales up the analysis to train the gaze on the regional and global, scales. In both these examples, the science and art of city-making will run as consistent threads through the analysis.

The 15-Minute City

The concept of the 15-minute city or "chrono-urbanism", introduced by French professor Carlos Moreno in 2015, exemplifies the power of partnerships. Moreno advocates for an urban setup where residents can access basic essentials within 15 minutes by foot or bicycle. This model hinges on four dimensions: density, where compactness of the city reduces long commutes; proximity, essential services are close to where people live, promoting healthier lifestyles and reducing environmental impact, and hence regenerative and restorative; diversity, involving mixed-use

neighbourhoods that foster vibrant community life; and digitalisation, where technologies enable tools such as ride-sharing apps and smart public transportation which reduce traffic congestion and enhance safety.

The successful implementation of the 15-minute city concept very much depends on the science of city-making. It involves understanding how urban spaces can be optimised for accessibility and functionality. But by decentralising urban services and creating more self-sufficient neighbourhoods, the model also strengthens relationships, with partnerships and reciprocal ties between business and residents. This allows both commercial success and community well-being.

The city's walkable infrastructure further promotes interaction in public spaces or "third spaces" like parks, cafes and libraries, fostering greater belonging and ownership within the community, particularly for marginalised groups like the elderly. This model also enhances relationships between residents and local government. According to Gallup polls, Americans generally have higher trust in local governments compared to other levels, primarily due to their responsiveness and proximity.

Building Resilient Supply Chains

Let me turn to a second example, that of maintaining robust supply chains, and draw attention to a larger scale of analysis than the micro-scale of the 15-minute city. Here, the science and art of city-making are again foundational, just as the intersections of resilience and regeneration are obvious.

However self-sufficient a 15-minute city is, it has to draw its goods and produce from elsewhere, and this becomes existential when considering food, water and medical supplies, for example.

The science of building resilient supply chains relies on advanced technologies and data-driven strategies - AI, blockchain, and data analytics enable cities to design more efficient and adaptable supply chains. Technologies facilitate real-time monitoring, risk management, and ensure availability of essential supplies, such as food and medicine, even during crises. Layer on sustainable considerations, integrating environmentally responsible practices in the supply chain management system, such as minimizing environmental impacts from the stage of product design to logistics to end-of-life management, and such green supply chains contribute to regenerative cities.

But the best of technological solutions will not suffice. Building resilient and regenerative supply chains also requires cultivating strategic and trusted partnerships between governments, businesses, and communities.

Businesses rely on suppliers to deliver quality products and services, and governments expect businesses to comply with regulations and global geopolitical standards. Stakeholders with high-trust relationships are likely to share information and feedback, improving quality and efficiency. Trust also reduces costs and risks associated with contracts and monitoring, enabling smoother transactions and lowering the need for costly safeguards.

Conclusion

Let me conclude.

The creation of resilient, regenerative and restorative cities is an urgent and multifaceted task. The solution is not found solely in scientific innovation and technology, important as they may be. It demands careful attention to the human dimensions of urban life—community, culture and trust. The science and art of city-making should really be twins in a pod, if we are to have cities that that can bounce back, give back and bring us back to health.

By balancing the science and art of city-making, we can ensure that our urban communities not only withstand adversity but thrive, providing sustainable, inclusive, and vibrant environments for generations to come.

Thank you.