Report of the third

Cities Roundtable

28 November 2014

Co-hosts:

Centre for Liveable Cities

Building Research Institute,
Housing and Development Board

Partner:

Research & Development Division,
Ministry of National Development

Executive Summary

Khoo Teng Chye, Executive Director, Centre for Liveable Cities

Introduction

On 28 November 2014, some 120 researchers from close to 40 public and private organisations attended the third Cities Roundtable at the Centre for Building Research in Woodlands. This was the largest Roundtable since the inaugural edition in 2012, which involved 40 participants.

The Centre for Liveable Cities (CLC) convenes the annual Cities Roundtable as a platform for Singapore-based researchers to network and share their latest work, with a focus on current, interdisciplinary and practical urban topics. CLC co-hosted the 2014 edition with the Building Research Institute (BRI) of the Housing and Development Board (HDB).

As CLC Executive Director Khoo Teng Chye explained, Cities Roundtable aims to present a snapshot overview of the latest local urban research, help to identify possible gaps in research areas, and promote collaboration within Singapore's urban research community.

Cities Roundtable 2014 was divided into three themed segments: Smart Nation; People and the Built Environment; and Sustainable Urban Solutions. The Roundtable curators identified these themes from a survey of current urban research by local organisations. Each segment featured presentations by invited researchers, followed by a panel discussion. CLC also compiled synopses of ongoing urban research in Singapore online: http://tinyurl.com/m7unouu

Overview of Presentations

Cities Roundtable 2014 revealed that smart technology is fast becoming integral to the work of research institutes and government agencies involved in studying, planning and governing the city-state. Presenters in the first segment showed how Singapore's drive to become a Smart Nation is being powered by technologies from 3D urban planning maps to crowd sourcing in local communities.

Complementing the technology-focused

research were back-to-basics projects investigating the development of healthy and humane urban environments. Studies of travel choices and recycling habits as well as the design of public transport environments and art-filled spaces showcased the growing maturity of 'softer' policy research.

The final segment showcased research into practical and sustainable urban solutions, such as monitoring systems for the elderly, and management technologies to support urban biodiversity.

With the growing digitisation of daily life, participants were reminded of the need to better understand this trend and its implications on different aspects of urban living. Another key issue that participants discussed was the need to improve the resilience of critical infrastructure systems in the face of their increasing connectivity and complexity.

Conclusion

In his address, BRI Group Director Dr Johnny Wong explained how HDB saw the opportunity to expand research efforts and drive innovation by working with various research entities in Singapore in order to produce solutions for greater sustainability and better living. This broader perspective is also reflected in the BRI vision.

Turning to the Cities Roundtable, he felt that it allowed all to catch up on the research projects undertaken by various parties, allowing overlaps to be identified and presenting possibilities for parties to explore collaborative efforts and create synergy. On BRI's part, Dr Wong shared that they had already identified possible collaborations with some Cities Roundtable presenters.

The consensus among participants was that Cities Roundtable remained relevant and should continue annually as it served a useful platform bringing diverse researchers together to share ideas to improve urban liveability and sustainability in Singapore. Participants also appreciated the Cities Roundtable programme format as an efficient way of touching on a wide range of related topics in a short period.

Smart Nation: Better Living, More Opportunities, Stronger Communities

In Singapore, the Smart Nation Programme Office (SNPO), which comes under the Prime Minister's Office, has set a vision for Singapore to be a nation that integrates IT, networks and data seamlessly to transform daily living and communities of the future.

Tan Kok Yam, Head, Smart Nation Programme, believes that with its good public infrastructure and high rates of Internet connectivity Singapore already has the ability to deploy technology to benefit the population quickly and decisively. "The first thing we need is a concerted approach to this," he said.

Apart from building up the technical systems, Mr Tan emphasised the need for a mindset of experimentation and innovation among individuals, research agencies and institutes as well as the public. "We need to have that kind of conversation and space in the public to push this envelop," he added, saying that we must be comfortable with the idea that some of the trials we run in public will fail.

To create a Smart Nation, Mr Tan said it is necessary to create an "eco system" where the public sees the value of technology in improving everyday living, and innovators are in turn encouraged by the adoption of their ideas to benefit society. "What is important is the idea of a virtuous cycle," he said.

Tan Kok Yam, Head, Smart Nation Programme Office, Prime Minister's Office

ESRI-URA City Engine Collaboration Project

The last five years has seen "enormous" advancements in various technologies, and these technological innovations in areas such as 3D simulation modelling, ground sensing, and Big Data analytics are now being integrated into a framework that forms URA's Smart Nation Integrated City Planning Tools.

Sharing of data is one of the characteristics of a Smart Nation and one example of this is URA's Online Development Register – a geospatial data app that allows the public to retrieve past development and planning decisions to ensure transparency in the market. Other developments include multi-platform planning tools such as ePlanner and a project to create detailed 3D urban model of Singapore that will incorporate analytic features like 3D shadow analysis.

Peter Quek, CIO, URA, revealed that URA is also working with ESRI Inc to explore the use of 3D GIS technology, such as advanced rule based City Engine software, for planning and urban design simulation. The objective is to explore building a 3D urban simulation system that can simulate, design, visualize and analyse various planning scenarios efficiently. The system would include a set of localised rule templates to perform urban analyses and simulation such as rule based parametric simulation tools.

Peter Quek, CIO, Urban Redevelopment Authority (URA)

Eugene Lau, URA

Mapping Singapore in 3D


Victor Khoo, Singapore Land Authority

The Singapore Land Authority (SLA) together with the Civil Aviation Authority of Singapore (CAAS) and the Public Utilities Board (PUB) has undertaken the task of creating and maintaining a geometrically accurate 3D national topographic map of Singapore.

It will provide a high quality 3D map that captures as-built 3D information of buildings, terrain and roads. Victor Khoo, Deputy Director, Land Survey Division, SLA, revealed that since the project was initiated earlier this year, over 40 tetra bytes of data using Rapid Data Mapping Technology – employing airborne as well as mobile laser scanning and imaging - has been amassed. This is the biggest geospatial dataset ever collected homogenously in Singapore to support analytics, added Mr Khoo. And when data collection is completely collected in 2015, SLA expects to produce 3D maps of the highest resolution. "It will be five-times more accurate than Google Maps," he said.

While PUB and CAAS require very accurate 3D maps for their planning purposes, SLA expects the 3D maps will also be useful to other agencies in various applications such as urban planning, environmental studies and coastal protection. As such, Dr Khoo said the 3D topographic map data will be modelled into an advance data format known as CityGML. This format is based on an international standard, will be open source and intelligent to allow 3D spatial analysis, simulation and visualisation. The format also ensures efficient data sharing among government agencies.

Social Media Analytics on Microblogging Data

Living Analytics Research Centre (LARC) is a joint research initiative between the Singapore Management University (SMU) and Carnegie Mellon University (CMU) and Lim Ee-Peng, Director of LARC, School of Information Systems at SMU believes that harnessing big data "is an interesting way to improve urban living". "If we can use data analytics to discover the mood of the people out there, sense their wants and needs, it will help in deciding what the new applications should be," he added.

Prof. Lim Ee Peng, Living Analytics Research Centre

By using social media analytics on microblogging data such as Twitter, LARC can derive useful consumer and social insights about users. "[Data] is everywhere. It just requires us to make the bold decision to use the data for a different purpose," he adds.

Citing an example where LARC repurposed data gathered from EZlink cards, Prof Lim revealed how it was able to not only ascertain departure and arrival times of commuters but also develop data analytical models to understand traffic congestion patterns.

Similarly, by analysing social media data - down to the choice of words used - LARC is able to make certain assumptions about the impact of recent events such as this year's National Day Rally and how the haze has affected consumer patterns.

A Smart Model of Rapid Transit Systems

*Dr Christopher Monterola, Institute of High Performance Computing, A*STAR*

One of the objectives of creating a Smart Nation is to improve its operational systems and nowhere is this more critical than in running of a rapid transit system (RTS). To this end, the Institute of High Performance Computing (IHPC), a research institute under the Agency for Science, Technology and Research, has collaborated with LTA to create a highly accurate interactive platform to help transport planners examine various travel related scenarios.

While it may seem that commuter journeys are quite predictable with assumed peak and off-peak hours, IHPC's data modelling reveals that Singapore's RTS is a complex system. "The system is in a constant state of non-equilibrium," said IHPC's Christopher Monterola. He added that while it is generally intuitive that people's MRT journeys start and end at same MRT station, what is not intuitive is that a large percentage of the journeys are not symmetric. "We don't trace same routes from home to work and work to home. And there are strong consequences of these findings," added Dr Monterola.

By analysing travel data, it was found that MRT journeys are generally non-linear and non-intuitive. Other data that has been incorporated includes the study of overloading, overcrowding, and travel delays resulting from disruptions, train or bus deployment frequencies, and/or various other population growth dynamics.

With the data combined into a single model, transport planners can now more accurately enhance their responses to disruptions as well as plan for future frameworks to cater to a growing rapid transit system. It is now capable of running full day simulations in a matter of four minutes.

Noting the increased emphasis on public transport and future population growth targets in Singapore, it is also important that the IHPC platform make projections for the future. On this point, Dr Monterola revealed that some initial projections have been made and studied - "Right now we have about 2.3 to 2.5 million user journeys per day. Our models predict that if this goes up to 3 million without any enhancement of the existing transport system, the average duration of trips will go up exponentially."

Crowd Sensing Systems for Data Collection

The advent of new technology such as Google Glass and other smart devices is giving rise to the possibility of new modes of data gathering in a Smart Nation. At the Complexity Institute (CI) at Nanyang Technological University, Luo Jun believes "humans can become sensors". "With all these extensions, we can get more data than what we could in the past," Assoc. Prof. Jun added.


Assoc. Prof. Luo Jun, Complexity Institute, NTU

At CI, Assoc. Prof. Luo is involved in crowd sensing. He defines this as data gathered from people who act as "sensors" (with their Smart devices) as opposed to social sensing which derives most of its data through open or public sources such as social media platforms.

Some applications of crowd sourcing include Indoor Localisation and CI is undertaking research on the feasibility of geomagnetism assisted crowd sensing to build maps assemble from "magnetic fingerprints" left by people carrying smart devices.

In certain applications, such as the vehicle-based crowd sensing app that provides parking data that CI is developing with BMW, there is a "mutually beneficial" relationship between the user and the service provider. "You will give and receive parking data when you install the app," explains Assoc. Prof. Luo. However, an app that requires monitoring of a city's PSI for instance "might need more incentivising," he said, adding, "People may not want to reveal what they see or do."

Discussion - Availability, Accessibility, and Privacy of Data

In spite lacking complete accuracy, the many presently available datasets are already sufficiently useful for researchers. Instead, the challenge was to ensure the user-friendliness and accessibility of any sharing platform, even for non-technical experts.

On the protection of data, Prof Lim Ee Peng from the Living Analytics Research Centre shared that there are review boards in place to set guidelines on how data is collected and used before research is carried out. This would boost data security and privacy, and support the anonymisation of data, especially for mobile data where it is possible to identify a person to a 95% degree of accuracy with just three well-defined different location points regardless of anonymity, as shared by Dr Christopher Monterola from the Institute of High Performance Computing at the Agency for Science, Technology and Research.

Further, the resolution of data collected may not necessarily be a a level which affects privacy. For example, Mr Victor Khoo from the Singapore Land Authority (SLA) shared that data collected for its nation-wide mapping project through its airborne laser scanning programme, while high, is not sufficient to reveal faces or car number plates.

Despite the limitations presently to ensuring full data privacy, Mr Tan Kok Yam of the SNPO shared that there are many positive externalities to be gained in sharing data.

Singapore as a Digital Village

Dr Carol Soon, Institute of Policy Studies, Lee Kuan Yew School of Public Policy, NUS

With advancements in Smart technology, communities and cities are increasingly occupying the virtual realm. Many everyday transactions already occur over the Internet with little need for a physical space from which to make these transactions. So it is not unthinkable then that cities one day become completely digitised. "It is not surreal fiction but an extremely plausible reality for Singapore," said Carol Soon, Institute of Policy Studies (IPS).

In its research project called 'Singapore as a Digital Village', the IPS focuses on how technology accords not just policy-makers but every citizen the opportunity and capability to help solve problems on a nationwide scale, and reconceptualises how people will organize themselves in the future.

Dr Soon believes microcosms of digital villages are already emerging. In Singapore, she cites local ground-up initiatives like Rent Tycoon which brings like-minded people together to participate in "collaborative consumption" or the buying and renting of unwanted chattel.

Microcosms of a digital village like Rent Tycoon are founded on the premise that, "people from different backgrounds will come together and act in concert to improve their lives when given the means," explained Dr Soon.

Apart from building a community spirit, applications that address aging and healthcare issues could even connect different users in real time so that eventually these issues become "self-solved".

Together with the Department of Communications and New Media and School of Computing in NUS, IPS is currently working on a project on bringing citizens from different walks of life together to deliberate on population issues.

Themed Cabin Experiment

At LTA's Transport Experience Lab (TEL), designers have been tasked to foster a positive commuter culture. "It's not about transport; it's not about faster, better, cheaper … It's about that human element that is missing in our daily commute," said LTA's Abdul Rashid Bin Adnan.

Abdul Rashid Bin Adnan, LTA Transport Experience Lab in collaboration with SMRT

Public transport is very much a shared social space and to impact the behaviour and interaction of the commuters and enliven the atmosphere, TEL came up with its themed cabin experiment. Mr Adnan believes that people actually want to talk to each other, "but how do you go about doing that if everyone you see on the train is actually plugged into their phones…?"

Very much a social experiment, TEL used "nudges" to engage commuters. In one experiment, a patch of Astroturf was used to draw commuters away from the doors and into the cabin. There was also a soccer themed cabin planned to coincide with this year's World Cup. "We can't exactly measure graciousness but we know that we can actually nudge people towards gracious behaviour through nudges," added Mr Adnan. Given the right "nudge", it was found that 60% of themed cabin commuters interacted with the surroundings either actively or passively and about 30% talked to others.

Study on Household Recycling in Singapore

The Ministry of the Environment and Water Resources (MEWR) conducted a study on household recycling. The main reason why respondents recycled was to "save the earth". Only a very small minority cited that monetary reasons would motivate them to recycle. MEWR also found that the main barrier to recycling was that respondents felt that they had too few items to recycle. The National Environment Agency (NEA) thus created a simpler system for households to aggregate their recyclables. To further help households recycle, NEA included information on steps to recycle on the MyENV app – a smartphone app that provides information on topics such as the weather and air quality.

Deborah Lee, Environmental Behavioural Sciences & Economics Research Unit, MEWR

Building a vibrant community in a dense environment

Dr Cho Im Sik, Centre for Sustainable Asian Cities, NUS

The Centre for Sustainable Asian Cities (CSAC) at the National University of Singapore (NUS) has developed a new tool for urban space analysis that can be used for different purposes such as strategic interventions and pre-evaluation, etc. It is one of the deliverables from a research collaboration with URA, HDB and NParks, funded by the Ministry of National Development (MND), Singapore.

This tool - TUSA (Tool for Urban Space Analysis) - is an integrated computational application that is flexible and can be adapted, with capacities to catalogue, evaluate, and analyse urban space typologies, and their performances. For example, if it is used in a strategic intervention for a specific case, it shows the evaluation of how well the urban space is performing, where the strengths and weaknesses are, and also recommends possible improvements through an automatically generated report.

CSAC is also involved in a research collaboration with NAC, that uses community-based assessment approach to evaluate the intensity of community engagement in the arts. And together with HDB, CSAC is looking at ways to give some space for community initiatives, to share responsibilities with the community and give the community of voice in the decision-making process. Two pilot projects have already been initiated in Tampines, namely the Neighbourhood Incubator and the Social Linkway.

Creating Healthy PLaces through Active Mobility

Talking about creating healthy living cities through active mobility, Remy Guo of the Centre for Liveable Cities (CLC) said that improving and promoting cycling, "is really more than just simply laying bike paths." He added: "In order to get to our desired destinations, we have to build and create a holistic system that is friendly to pedestrians and cyclists."

Mr Guo highlighted that in Singapore, the urban capacity for motorised transport is reaching its limits with 12% of land area already dedicated to roads. Looking at the transformative stories of the cities around the world, CLC, which is part of the Ministry of National Development (MND), found that other than the infrastructural aspect, there are also softer aspects such as leadership and culture which are important in transforming the cities and making them less car-centric.

In its research project on active mobility, CLC explored how urban environments can be made friendlier to walking and cycling. Ideas for promoting active mobility were based on workshops led by global expert Jan Gehl.

Remy Guo, Centre for Liveable Cities, MND

Discussion - Motivations behind environmentally sustainable efforts

An interesting contrast which surfaced at the People and the Built Environment segment exemplified the importance of individual benefit in an individual's motivations to take action on environmentally sustainable acts. Outwardly similar environmentally sustainable efforts such as recycling and active mobility through cycling (a convenient and cheap mode of commuting) were adopted for vastly dfferent reasons. Ms Deborah Lee from the Ministry of Environment and Water said in the case of recycling, "there is not much of an outcome for yourself. So the outcome would be that you save the environment." Cycling, on the other hand, may be a more self-serving activity with the priority being to get to one's destination on time. But a commonality that prevails in increasing motivations in performing such acts is the convenience and ease of access for promoting both cycling and recycling.

Understanding the underlying motivations as to what drives people and how they interact with the environment is perhaps one aspect to consider for an urban solution. To encourage people to recycle more, one participant suggested if monetary incentives like a deposit refund or the role of "Garang Guni" (recycling collector and reseller) could be harnessed. Ms Deborah Lee agreed that such incentives might be highly effective but cautioned on the need for more thorough design. She informed that based on California's experience, systems such as deposit refund can lead to undesirable outcomes such as "dustbin raiders" making a mess around the bins, or people driving in from other states with track-load of recyclables to take advantage of the system. Garang Guni is also very selective in what they want and may or may not complement the recycling efforts.

Developing Sustainable, Biophilic and Smart Towns

Alan Tan, Housing & Development Board

With sustainable urban solutions being test-bedded in HDB's estates and towns, big changes can be expected in the way HDB's living environment looks and performs. HDB is embracing Smart technologies and has already developed a strategy to develop Smart Towns. This strategy involves Smart planning, Smart environments, Smart estates and Smart living.

With Smart planning, HDB is employing advanced simulation tools, "to help us to plan our towns more efficiently and more sustainably," said Mr Tan. This means incorporating climatic considerations like wind flow, solar radiation and shadow casting into the design process upfront at an earlier stage.

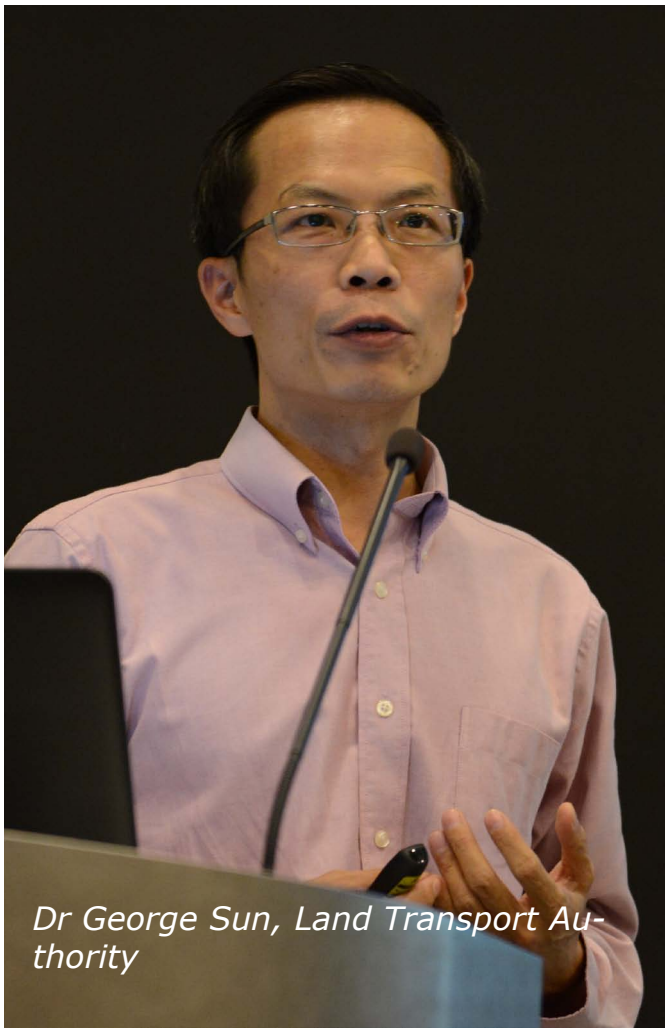
Another aspect is the adoption of Smart estates innovations, where HDB is looking at Smart Lighting, Pneumatic Waste Conveyance System, and Geobarrier Systems for better energy efficiency, and to optimise the operation and maintenace requirement in estates. These will be tested in HDB's showcase project – Northshore – which it envisions as a Smart and Sustainable district.

HDB's Biophilic Town Framework aims to assess the impact of greenery to further enhance the wellbeing as well as the health of the residents in HDB estates. Moving forward, HDB is embarking on the development of Sustainable, Smart and Biophilic towns that will draw upon the ongoing works in Punggol Eco-Town, as well as the Greenprint pilot project in Yuhua, urban environment modelling and various other research projects to make HDB's towns more liveable. This is also in line with the key thrusts spelled forth in HDB's Roadmap for Better Living in HDB's Towns.

Commuter Travel Behaviour Choices and Travel Smart Pilot

Between Aug 2012 and Sept 2013, LTA worked with the Institute of Systems Science (ISS), NUS, to study the commuters' travel choices. Through a series of Focus group discussions, field observations, interviews with service providers, and surveys of 1,500 commuters, the study has identified factors which affect commuters' travel choices in Singapore's context.

Through the Travel Smart pilot launched in October 2012, LTA has been working with 12 organisations, from both the private and public sectors, to help their management further understand the travel needs and attitudes of their employees, and put in place the necessary workplace practices to encourage off-peak travel and/or reduce travel demand of their employees. Shifting travel demand will help spread out the morning peak hour crowds to the off-peak periods, and ease crowding during the morning peak period to improve commuters' travel experience. At the same time, the Government is actively increasing public transport capacity through building new rail lines, buying additional trains, as well as putting more buses on the road. Riding on the success of the pilot, LTA has formally launched the Travel Smart programme in July 2014.



Dr George Sun, Land Transport Authority

Urban Greenery and Biodiversity in Dense Environments

Dr Chong Kwek Yan, Centre for Sustainable Asian Cities

Even in areas where Singapore appears to have done well, for instance in providing urban greenery, there is still room to be environmentally sustainable. Using satellite imagery and on-ground surveys, a study by the Centre for Sustainable Asian Cities (CSAC) found that in Singapore bird and butterfly communities associated with cultivated greenery are less diverse compared to communities associated with natural greenery. It also found that among different components of cultivated greenery, places with higher tree cover have higher numbers of bird species, and places with higher density of road lanes have lower numbers of bird and butterfly species.

These results suggest that cultivated greenery should not be used as a substitute for the loss of natural greenery. The planning of greenery for biodiversity should also take into account urban conditions such as effects of roads and traffic.

The CSAC has also created models that can develop targets for greenery by predicting the amount of species richness based on greenery and its interaction with urban factors like traffic.

CSAC is also hoping to integrate its software with relevant agencies and industry players such that they know that they have a certain target of greenery to achieve for particular areas. However, work remains to be done to translate other "multidimensional" aspects of measuring biodiversity for greenery planning. Until this is done, "it's not just the quantitative targets that we need to talk about," added Dr Chong.

Future Resilient Systems (FRS)

With so much information that needs to be shared on the Internet in a Smart Nation, one must ask how resilient and robust these systems will be. Hans-Rudolf Heinimann of Future Cities Lab (FCL), Singapore-ETH Centre, noted that what is emerging is a phenomenon he calls "a system of systems" – a system of interconnectedness that could break down with the smallest breach. "You will see patterns of behavior of this type of systems that we never observed in the past," Dr Heinimann added.

Smart Nations of the future may need to depend on "critical infrastructure systems" which FCL defines as the "backbone" that provides a reliable energy supply, plus transportation, communication, banking and finance, emergency, and other services that are essential for maintaining the "metabolism" of urbanised societies.

The FCL has established a research platform called Future Resilient Systems (FRS) which looks at and studies systems under stress and how they respond. This is particularly relevant when developing a Smart Nation. "We should always think beyond what can be done. This is what we would like to do in this project," added Dr Heinimann.

Dr Hans-Rudolf Heinimann, Future Cities Lab, Singapore-ETH Centre

Overview of Discussion - Pursuing a biophilic living environment and managing trade-offs

The final segment on Sustainable Urban Solutions distilled more practical limitations as city planners and builders tried to provide solutions while tackling constraints and trade-offs. Providing more clarity on HDB's biophilic programme, Alan Tan said that with respect to preserving mature trees, sometimes a balance must be struck. "But as far as possible, I do agree that whenever chances allow us, without compromising other considerations, we should retain mature trees as much as possible," he added. Johnny Wong also added that HDB is not looking at just planting trees. "We're looking at the whole ecosystem. We are actually looking in terms of preserving species," he said. HDB works closely with NParks to identify what trees they could preserve. Beyond greenery, biophilic is also about looking at different species and it takes a whole process of educating and building awareness.

In response to a question as to whether trade-offs could be quantified in the context where nature preservation will be in conflict with developmental or economic growth, Dr Chong Kwek Yan from the Department of Botany, NUS, said that people have been doing surveys, asking what people like to have, say in Pulau Ubin. "It's these surveys…if carefully tweak, I believe it can actually measure some of these trade-offs between people's choices between wanting to have more nature, more heritage or wanting more amenities and so forth ... and a list of such questions can actually allow you to evaluate what the rank and choices that people have."

Co-Hosts

CENTRE for LiveableCities SINGAPORE

Set up in 2008 by the Ministry of National Development and the Ministry of the Environment and Water Resources, the Centre for Liveable Cities (CLC) has as its mission "to distil, create and share knowledge on liveable and sustainable cities". CLC's work spans three main areas – Research, Capability Development and Promotion. Through these activities, CLC hopes to provide urban leaders and practitioners with the knowledge and support needed to make our cities better.

HOUSING & DEVELOPMENT BOARD

The Housing & Development Board (HDB) is Singapore's public housing authority and a statutory board under the Ministry of National Development.

HDB's mission is to provide affordable homes of quality and value, to create vibrant and sustainable towns, to promote the building of active and cohesive communities and to inspire and enable all staff to give of their best.

The formation of the Building Research Institute (BRI) signifies HDB's priority to better focus its efforts in R&D to achieve our aim of improving the living environment and creating endearing homes for our residents.