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SINGAPORE

Experts consider Singapore and New York to be smart cities. But while Singapore's visionary, comprehensive style can seem nebulous and removed from the ground, New York's multi-stakeholder, pragmatic approach looks ad-hoc. CLC researchers Zhou Yimin and Anna Ponting consider how such different models deliver similar outcomes, and suggest lessons for cities trying to get smart.

Figure 1: View from the High Line of the upcoming Hudson Yards project, billed as New York City's first "quantified community". *Image credit: Steven Severinghaus / CC BY-NC-SA 2.0.*

Lessons from New York for Singapore's Smart Nation Journey

INTRODUCTION

In essence, the smart city is a comprehensive urban management model which promotes efficiency and control on the one hand, and inclusion and participation on the other. It leverages and harnesses modern technology to enable cities to function more reliably and sustainably for all residents.

Singapore's Smart Nation initiative, announced in November 2014, has garnered interest from urban planners, technologists, entrepreneurs, and public sector officials around the world. Sidewalk Labs, a New York City-based company working on smart city technologies, believes that the initiative will push Singapore "to the next level of urbanity in the digital age" (Jaffe 2016). The Wall Street Journal, remarking on the breadth of the project, has noted that "it is a sweeping effort that will likely touch the lives of every single resident in the country" (Watts 2016). Unlike more ad-hoc "smart" initiatives in other cities, Smart Nation represents a deliberate and defined government plan. According to the Smart Nation Programme Office (SNPO) which leads the initiative, the ultimate aim of Smart Nation is to "to support better living, stronger communities, and create more opportunities, for all". Smart Nation is therefore an opportunity to engage meaningfully with business and civic leaders, as well as the broader public, so as to address the nation-state's specific future needs.

New York City lies on the other end of the smart city spectrum from Singapore: it has done much to encourage the use of technology in municipal government, to bolster its start-up community, and to connect with its residents, but has done little to raise its profile as a smart city. Looking at New York City may help to highlight the fundamental components of a smart city and underline lessons Singapore could learn from New York's experience, while recognising the differences that each city's context demands.

GLOBAL EMERGENCE OF THE SMART CITY

Urbanists have long considered technological trends and how they might alter the urban form. As far back as 30 years ago, variations on the smart city concept have been proposed: these include *the wired city, the digital city, the intelligent city, and the ubiquitous city*.

The smart city is one that is driven by information and towards innovation. Of course, the smart city cannot be "smart" without the effective use of modern

> It is Smart Nation's very distinctiveness from the "smart city" that gives Singapore an opening to develop its own capacity for planning urban operations for and with its citizens.

Image credit: Fitbit Surge

Image credit: George100 / CC BY-SA 3.0

Figure 2: Various smart devices supported by sensors

technology; ignoring this distinction—as some do by affirming that the smart city is not about technology—risks over-generalising the concept. The pertinent infocomm technologies (ICT) include sensors, high-speed broadband, smart meters, remote monitoring systems and other tools that facilitate the use of data to improve efficiency and automation. On the other hand, a common misconception is that the smart city is only about technology and connectivity. Instead, it is about using technology to enable citizens, government and business leaders to make more informed decisions.

As a tangible goal, the smart city poses many challenges. Because the concept is not static and does not have a set of established metrics, it is difficult to imagine a point at which a government will be able to declare definitively that they have transformed their society into a smart city (or nation). Furthermore, the smart city is easily confused with the general proliferation of ICT in modern life. Is a city smart when its smart phone usage rate reaches a certain level or when a critical mass of sensors is installed? This paper contends that the smart city is not composed strictly of hardware. The smart city encompasses the notion that technology should address the needs of the citizens; the elements of social capital and public engagement is less easily defined, and thus often overlooked.

As a result of this oversight, the term 'smart city' has become encumbered with unproductive associations. Taken to their logical conclusion, many conceptions of the smart city would result in an urban fabric in which everything is optimised. Autonomous vehicles would reduce travel times by removing inconsistencies and errors in human driving patterns; washing machines would automatically turn on during dips in electricity demand; e-Government services would eliminate the need for citizens to visit physical offices. This interpretation of the smart city is akin to regarding sustainability as being the use of compact fluorescent light bulbs, hybrid vehicles, and compostable utensils. Both the smart city and sustainability require a much broader strategy that engages the public to change behaviour, norms, and expectations.

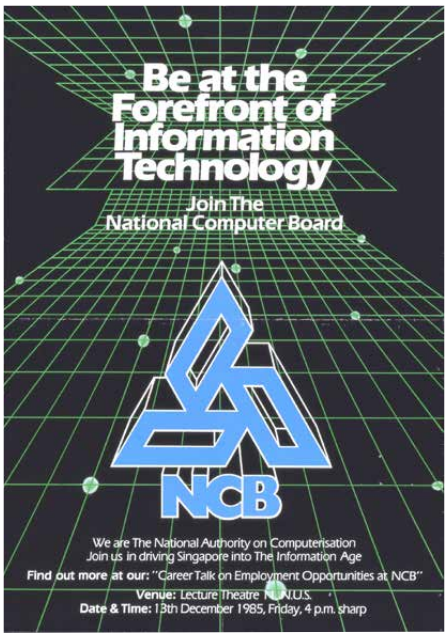

Figure 3 *(left)*: A talent recruitment poster by Singapore's National Computer Board, 1985.
Image credit: National Computer Board Collection, courtesy of National Archives of Singapore.

Figure 4 *(below)*: Computer stations at Singapore's Housing & Development Board, 1986.
Image credit: Ministry of Information and the Arts Collection, courtesy of National Archives of Singapore.

WHAT IS SINGAPORE'S SMART NATION CONCEPT?

Much of the curiosity about Smart Nation comes from its subtle distinctiveness from other smart city initiatives. Because of Singapore's unique status as a city-state, it is effectively the only city in the world that can produce a smart "nation" plan. How it will differ from efforts in Barcelona, Helsinki, Amsterdam, Seoul, New York City, and other cities at the forefront of the smart city trend remains to be seen. Is it a marketing strategy in which Singapore is the first "smart nation" by default because of its uniquely small geographic boundaries? Or, more significantly, is Smart Nation a departure from the smart city model as it has been articulated so far?

The Oxford English Dictionary defines the word nation as "a large body of people united by common descent, history, culture, or language, inhabiting a particular state or territory." The word city is defined as "a large town" (and a town is "a built up area with a name, boundaries, and local government that is larger than a village and generally smaller than a city"). The word nation thus connotes a social concept, while the city is an organisational and management concept. While arguably only a matter of semantics, the choice of the word nation signifies an emphasis not only on Singapore's institutions and infrastructure, but also its people.

However, Singapore has arguably displayed limited commitment to the people-centric model it articulates in communications around the Smart Nation concept, and has yet to fully capitalised on the opportunity to engage residents which it represents. The Smart Nation initiative is positioned as critical to maintaining Singapore's competitiveness and quality of life, yet it appears on the surface to be a replica of other smart city initiatives. Nevertheless a coherent, socially engaging Smart Nation programme can still be developed. It is Smart Nation's very distinctiveness from the "smart city" that gives Singapore an opening to develop its own capacity for planning urban operations for and with its citizens.

EVOLUTION OF SINGAPORE'S NATIONAL TECHNOLOGY POLICY

The smart city is not, in fact, a dramatic shift for Singapore. Singapore has been comprehensively exploiting technology to run the country: there are various systems and tools in different sectors that facilitate decision making, improve service standards, and achieve a high quality of life for the citizens. Most importantly, Singapore has adopted an integrated approach in the planning of the country and subsequent implementations, which is smart governance at the strategic level to begin with.

Singapore's global leadership in technology was stimulated as early as 1981 with the formation of the National Computer Board (NCB). President Tony Tan, then-Minister for Trade and Industry, demonstrated

> That Smart Nation articulates few new ideas is not a criticism, but rather recognition of Singapore's consistent vision for technology, which has simply taken on a new name.

foresight when he said: "Our success in computerisation will also depend on how our general population reacts to the changes that are happening and that will continue to happen unabatedly. The computer may be a tool for professionals but it will soon be a common feature in offices, factories, schools and the home" (1983). This crucial step, which preceded the advent of the internet and modern infocomm technology, marked Singapore's entry into the knowledge economy.

In 1998, the NCB was tasked with developing the IT2000 Masterplan for Singapore. Its vision was to "Transform Singapore into an Intelligent Island, where the use of information technology is pervasive in every aspect of our society, at work, at home and at play." By 2003, Singapore's Economic Review Committee aimed to position Singapore as a Living Lab in which to create, test, commercialise, and deploy innovative and complex ICT solutions; its report emphasised that "ICT will be an integral part of the economy and society, that will transform the way people live, work, learn and play". These plans were further articulated in the Intelligent Nation 2015 Masterplan. The current Smart Nation initiative again reiterates that "advances in digital technology have opened up new possibilities to enhance the way we live, work, play and interact."(2016) Repetitive language aside, Singapore's consistent focus on the adoption of cutting-edge infocomm technology as an economic driver is clear. Singapore's Smart Nation journey began long before the articulation of the current vision in 2014.

Just as the vision for these technology plans has remained relatively constant, so have their goals. The objectives of the Intelligent Nation 2015 (iN2015) Masterplan have

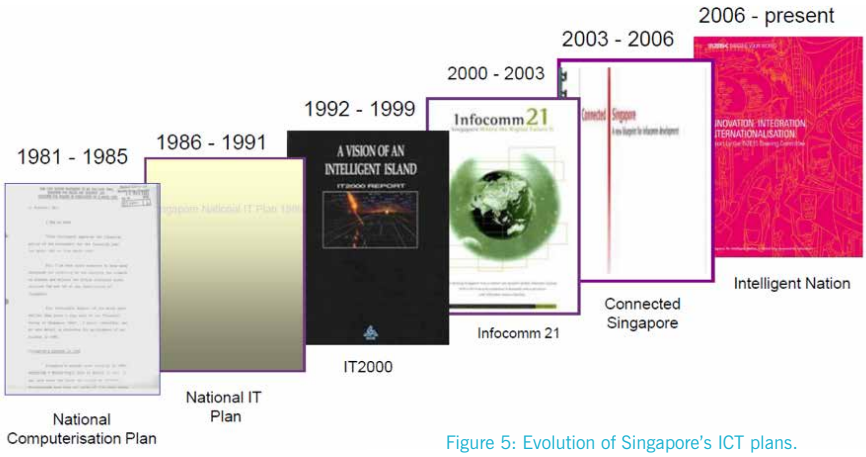

Figure 5: Evolution of Singapore's ICT plans.

also been reiterated in the Smart Nation initiative. At the launch of these initiatives in 2006 and 2014 respectively, the then-Ministers of Communication described the respective plans as follows:

Dr Lee Boon Yang, announcing iN2015: "The iN2015 Masterplan is not only about economic competitiveness. We will also be exploring ways to ensure that the elderly, less-privileged and people with disability can also enjoy connected and enriched lives or self-improvement and life-long learning. This is to bridge the digital divide and create opportunities for all." (2006)

Dr Yaacob Ibrahim, announcing Smart Nation: "Our goal is to establish Singapore as a Smart Nation that taps on the potential of infocomm and media, and that nurtures innovative talent and enterprises. In this way, the ICM sectors can bring about economic growth and social cohesion, and better living for our people." (2014)

As is reflected in these quotes, Smart Nation is not a deviation from previous technology efforts by aiming for "social cohesion" and "better living" through a more connected society. It is, rather, a natural progression from iN2015, which itself grew out of the IT2000 Masterplan, and so on. That Smart Nation articulates few new ideas is not a criticism, but rather recognition of Singapore's consistent vision for technology, which has simply taken on a new name.

NEW YORK CITY

Urbanists and technologists have labelled New York City (NYC) a smart city since long before the city government acknowledged the term. NYC does not have a taskforce or agency dedicated to promoting smart city initiatives, nor does it position itself on an international stage as a smart city. In 2015, the NYC Mayor's Office of Technology and Innovation released, with little fanfare, a report called *Building a Smart + Equitable City*, a short summary of NYC's technology and innovation initiatives. It reads as a half-hearted attempt to keep up with the smart city discourse dominating urban policy circles, ticking off the smart buildings, smart energy, and smart mobility categories with a handful of unrelated projects. In fact, it seems that these projects were only grouped

> By linking the CV pilot to an existing, high priority aim, New York City has been able to tailor technology to the city's particular needs.

under a common smart city agenda for the purposes of this report. However, despite not taking ownership of the term, New York City has been a pioneer in technology-driven policy and stands as a global example of how to leverage digital tools at the local government level. It is, by many accounts, one of the world's smartest cities.

The city's transition towards high technology began in earnest under former Mayor Michael Bloomberg, who emphasised accountability and measurement in municipal operations. This style of leadership demanded greater use of technology and data to monitor relevant metrics, which were published annually in the Mayor's Management Report. This thrust towards public disclosure of data to reflect the state of the city made NYC a pioneer in the Open Government movement. A number of other examples illustrate NYC's particular way of becoming a smart city: [I] using technology to improve city operations; [II] publicly releasing data to build trust through transparency; and [III] empowering non-governmental partners to collaborate with the City in co-creating solutions.

These examples also reveal a fundamental difference in the way that Singapore and New York City approach their respective urban technology and innovation efforts. While Singapore has used Smart Nation as a grand, integrated launch pad for its ICT projects, New York City has incorporated technology into its operations in a more piecemeal way—agency by agency, project by project—without ever using the term "smart city" as its motivation. Interestingly, the cities have achieved similar outcomes in leveraging technologies to achieve better governance and to improve the quality of life for their citizens, and both are frequently mentioned among the world's smartest cities.

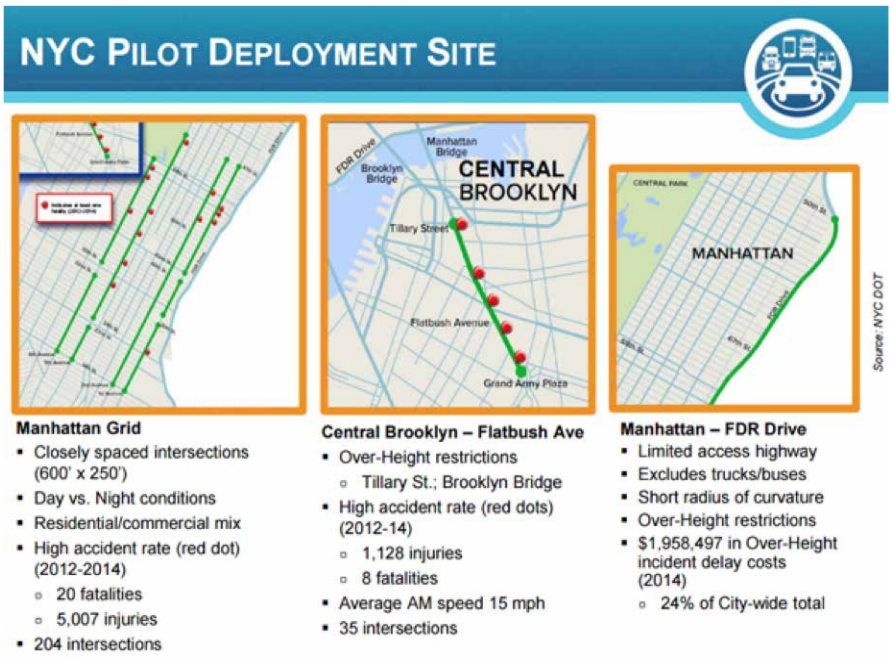

Figure 6: Pilots sites in New York City for Connected Vehicle Deployment Program.
Source: NYC Department of Transportation. "FHWA Connected Vehicle Pilot Deployment (CV Pilots) Program: NYC CV Pilot Deployment Presentation.

I. USING TECHNOLOGY TO IMPROVE CITY SERVICES

New York City connected vehicle pilot deployment program

While the United States does not have a national-level smart city programme as comprehensive as Singapore's Smart Nation, the U.S. Department of Transportation (USDOT) has taken a targeted approach to encourage technological development particularly in urban transportation. In 2015, New York City was selected by the USDOT as one of the first three deployment sites for the Connected Vehicle (CV) Pilot Deployment Program. The pilot program will be implemented by New York City's Department of Transportation (NYCDOT)[1], which will receive $20 million in federal funds. The CV pilot will evaluate the safety benefits and challenges of implementing connected vehicle technology in a dense urban environment.

The pilot will be made up of up to 10,000 fleet vehicles to be equipped with aftermarket safety devices. This includes approximately 7,500 taxis, 1,500 public buses, 500 sanitation and service vehicles, and 500 UPS delivery vehicles in Manhattan. Significantly, the pilot will extend beyond public sector stakeholders by including UPS and taxi companies, which are privately owned. This data coming out of the pilot will be used to improve vehicle flow and pedestrian safety in high-priority corridors.

[1] The programmes involves using connected vehicle technologies to improve safe and efficient truck movement, exploiting vehicle-to-vehicle and intersection communications to improve vehicle flow and pedestrian safety in high-priority corridors in the City.

> NYC is currently progressing from making its data "open" to making it "open + usable."

NYCDOT has been deliberate in its selection of pilot sites, which are high profile areas in need of safety improvements and are representative of different street network typologies. The site in Midtown Manhattan, for example, will cover 204 intersections along high accident rate arterials that were the site of 20 fatalities and 5,007 injuries from 2012-2014. There will be additional deployment sites along a limited-access freeway and a high-traffic arterial. By placing the test sites in congested, visible areas of the city, the DOT is able to increase the relevance and broader applicability of the results.

Likewise, New York City has been explicit in its goals for the pilot: it is focused on the safety applications of connected vehicle technology, prioritising the elimination of traffic deaths over other goals. This aligns closely with NYC's 'Vision Zero' initiative to eliminate traffic deaths by 2024. By linking the CV pilot to an existing, high priority aim, New York City has been able to tailor technology to the city's particular needs. This contrasts sharply with "smart" projects that begin with a technology of interest, rather than a problem statement, as their foundation. And while NYCDOT has not identified the project specifically as a smart city initiative, it decidedly embodies the notion of an information-driven, technology-enabled, local context-oriented solution that will make transportation more efficient and enable drivers and planners to make better decisions.

II. DATA TRANSPARENCY TO BUILD TRUST

Open Data

Just as the creation of the National Computer Board in 1981 was a legislative milestone in Singapore's Smart Nation journey, so NYC's move towards becoming a premier digital city began with state-level legislation. The New York State Public Officers Law, which came into effect in 1978, includes what is known as the Freedom of Information Law (FOIL). It requires government agencies, including municipal authorities, to provide records to the public upon request, with no explanation needed for the request. The law makes all records public by default, unless an exception permits an agency to deny access (mostly when disclosure would cause damage to an individual or prevent the agency from carrying out its duties).[2] The language used in FOIL's legislative declaration is strong, demonstrating the importance of public disclosure, at least philosophically, in New York's governance:

"The people's right to know the process of governmental decision-making and to review the documents and statistics leading to determinations is basic to our society. Access to such information should not be thwarted by shrouding it with the cloak of secrecy or confidentiality. The legislature therefore declares that the government is the public's business and that the public, individually and collectively and represented by a free press, should have the access to the records of government in accordance with the provision of this article"

(New York Public Officers Law §84).

By the 2000s, open data had become firmly associated with technology and innovation and was no longer legalistically defined merely as records that could be accessed by the public. In addition to complying with state-level legislation, in 2012 New York City passed what was called the most progressive local open data law in the United States.[3] This law put in place a timeline for making public data available via the NYC OpenData portal, signalling a shift from requiring the public to request specific information to proactively putting data in the public sphere. With more than 1,400 datasets covering all City agencies published on its open data portal — by 2018, there will be 1,600 — New York City has delivered on its promise of open government.

NYC is currently progressing from making its data "open" to making it "open + usable." In short, this means that datasets is to be released in machine readable formats, lowering the barrier for actual usage of the data. The City has drawn upon the advice and expertise of civic technology groups such as the New York City Transparency Working Group and BetaNYC as it develops its policies. The de Blasio mayoral administration's open data plan also emphasises community partnership and user-friendly data that does not require knowledge of complex analytics to understand.

CheckbookNYC

Another incarnation of open government in New York City is a platform called Checkbook NYC, which lets users view and track how the city government spends its more than $80 billion annual budget. This unprecedented access allows citizens, businesses, academics, and journalists to closely examine public expenditures, keeping government accountable and leveling the playing field for businesses competing for public contracts. The platform includes data such as vendor

[2] The definition of a public record is broad and includes emails from government accounts. Public sector salaries—applicable to City employees all levels—are also proactively disclosed by the NYC Office of Payroll Administration annually, with no FOIL request needed.

[3] Local Law 11 of 2012 added a new chapter regarding public data to the New York City Administrative Code.

> Active academic, journalist, and tech communities provide constant feedback to City officials. While this relationship can be tense, the city ultimately benefits.

names, contract amounts, and payments to both prime contractors and subcontractors working on taxpayer-funded projects.

Launched in 2010, CheckbookNYC was created by the NYC Office of the Comptroller, the independent chief fiscal officer and chief auditing officer of the city. The CheckbookNYC web application is open source—a choice the City made to prevent vendor lock-in and to offer other governments the ability to adapt the platform for their own financial transparency efforts. The source code is published on Github, where there are also forums for technologists to discuss issues and improvements.

CheckbookNYC's tools allow average citizens and data savvy users alike to examine New York City's financial data. The web application's interactive charts and graphs eliminate the need for heavy analytical work, although developers can also query the database or access data feeds for their own applications through the CheckbookNYC API.

A crucial component of what defines NYC as smart city is a smart citizenry: the city's active academic, journalist, and tech communities provide constant feedback to City officials. While this relationship can be tense, the city ultimately benefits from an ecosystem in which information transparency opens new avenues for public engagement, participation, and accountability. While Singapore may be moving incrementally towards a public sector culture of greater disclosure, its open data portal is less robust and there is not a vigorous citizen developer community to match the one in NYC.

III. NON-GOVERNMENTAL PARTNERSHIPS TO CO-CREATE SOLUTIONS

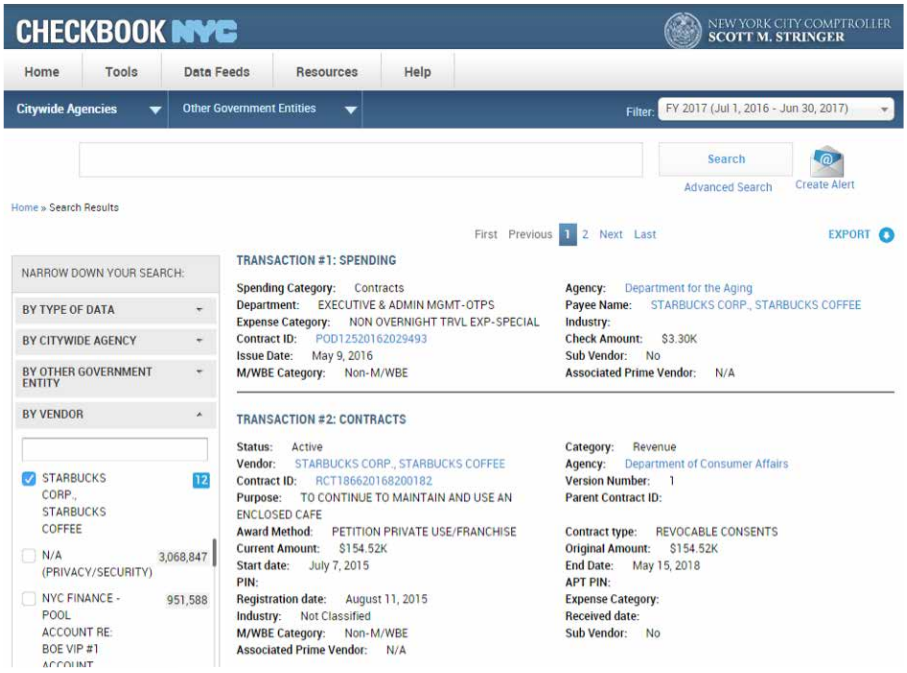

Figure 7: A search of the City of New York's spending on, and revenue from, Starbucks in Fiscal Year 2016-17. *Image credit: Checkbook NYC.*

Hudson Yards

Hudson Yards, the largest private real estate development project in the United States, is also set to be New York City's first so-called "quantified community". The 28 acre (more than 113,000 m^2) site is currently under construction on Manhattan's West Side, where 17 million square feet (nearly 1.6 million m^2) of new commercial, residential, and civic space will be built on top of a functioning railyard and be encircled by the northern terminus of the High Line.

Hudson Yards will include sustainability measures such as a composting program, rainwater recycling, and a co-generation plant that will provide 70% or more of the development's energy needs and protect it from disruptions such as storms (Libby). More significantly, the development will collect robust amounts of data on many environmental factors, including air quality and real-time greenhouse gas emissions. While this has been criticised by some as an overreliance on and fetishisation of data, Hudson Yards' concept of quantified community distinguishes itself by its emphasis on behavior and even social equity. The main partner on the project is New York University's Center for Urban Science and Progress (CUSP), a public-private research institute focusing on the science of cities.

By seeking to measure behaviour—how people interact with their space, how the environment affects health and productivity, etc.—and not just infrastructure performance, the project at Hudson Yards recognises the complexity of cities described by leading urban

> Diversifying the urban solutions arena allows for creative funding strategies, diffused risk, and ultimately more ideas.

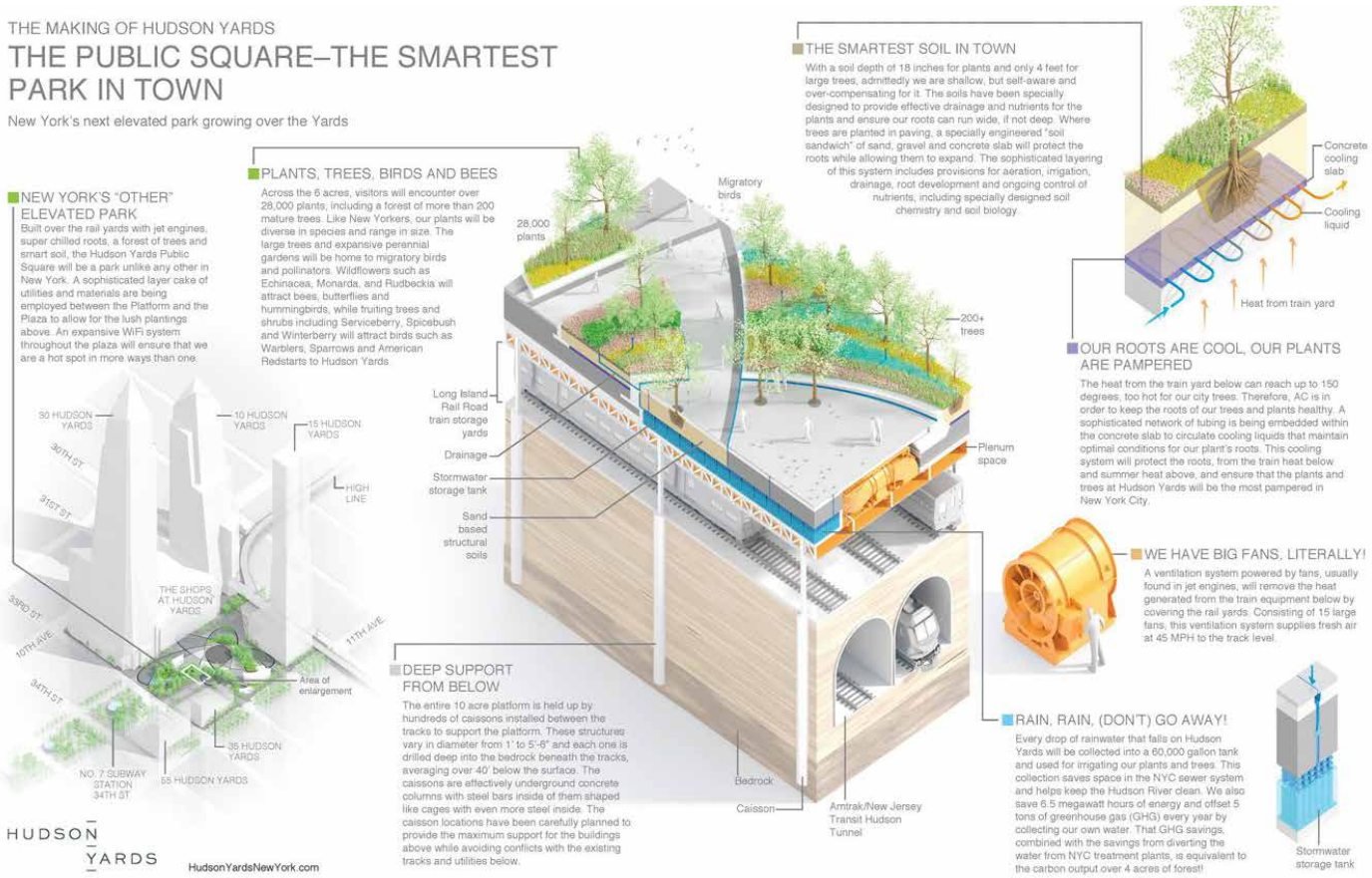

Figure 8: Sustainable features driven by smart devices at Hudson Yard's mixed development. *Image credit: Related Companies.*

academics such as Luis Bettencourt. Constantine Kontokosta, CUSP's lead on the project, points out that their approach begins with important social science questions which are then addressed by finding the data they need, rather than forcing problem statements unto existing data. The ultimate aim of the quantified community is "understanding how the data influences behaviour, and using the type of information that's now available to really democratise the planning process much more," (Libby 2014).

Admittedly, there is an apparent contradiction between using data from Hudson Yards—a behemoth project by a behemoth developer—and democratising the planning process, but the project will inform the implementation of urban informatics infrastructure in future developments. In many ways, the project is reminiscent of Singapore's Housing Development Board smart homes in Punggol: there is a heavy focus on sustainable living, leveraging ICT, and a nagging uncertainty about how the data will be used.

However, it highlights an important lesson in the diversity of stakeholders involved. New York City's government created the ecosystem for such urban innovation to occur by providing significant funding for the creation of CUSP and providing tax incentives to Related, the developer of Hudson Yards. Yet, the city government itself is not the driving force behind the quantified community. Diversifying the urban solutions arena allows for creative funding strategies, diffused risk, and ultimately more ideas.

> Perhaps greater central coordination would allow New York City to deploy its projects at the speed and scale that Singapore has been able to achieve.

CONCLUSION

New York City is a smart city not because it has achieved ubiquitous connectivity or real-time measurement of all its operations, but because it uses data and technology to solve urban problems rather than merely observe them. Throughout the city one can now find sewer and air quality sensors, traffic and police cameras, GPS taxi tracking, rooftop sound sensors, chemical and radiation sensors, infrared cameras, and Wi-Fi-enabled trashcans, but unless they produce actionable insights, these technologies do little more than make the city networked, not "smart."

The examples explored above are emblematic of New York City's pragmatic approach to technology-driven policy and projects. They all begin with a problem statement and use technology to better understand and address the issue. This is in contrast to the tendency of many smart city projects to use as their starting point a technology or platform that is applied broadly and indiscriminately. While there is certainly value in collecting extensive data without a particular purpose—which allows for observing patterns and employing inductive reasoning—it is particularly important for a government to be targeted in its interventions to realise practical value in the smart city. Also essential is New York City's commitment to transparency and cross-sector collaboration, both in the form of open data and non-governmental stakeholder engagement.

As a comprehensive vision, Singapore's Smart Nation is not well-understood by the public—or, in all likelihood, by the public service. However, since the vision was launched in late 2014, there has been incremental progress towards providing a fuller understanding. The Smart Nation Programme Office's most recent articulation of what the Smart Nation will mean in practice is by far the most helpful yet, as it outlines the key areas of focus: transport, home & environment, business productivity, health and enabled ageing, and public sector services. For New York City, this same list might look slightly different: equity and inclusion, safety, citizen engagement, transport, and public sector services.

Of course, the governance systems in each city mean that their approach cannot be identical, just as their smart city initiatives should not necessarily target the same issues. Substantial government support is inevitable in Singapore. It should be noted that advancing Singapore's technological vision has relied heavily on public funding for innovation—a critical tool that New York City is unable to leverage to the same extent due to budget constraints. As such, Singapore's support for research and development has been consistently strong over the past two decades. As part of the Research Innovation Enterprise 2020 Plan, "Urban Solutions and Sustainability" is considered a distinct domain for the first time. The domain will receive S$900 million over the next five years, a strategic move that recognises Singapore's competitive advantage and national needs in this area. This commitment to R&D for urban solutions is an important component of Smart Nation that, if combined with pathways for commercialisation, provides opportunity to drive growth in Singapore's entrepreneurial ecosystem.

It can and should be argued that Singapore has always been a Smart City. As the CLC Liveability Framework succinctly explains, integrated planning and strong urban governance have created a development ecosystem that is methodical and progress-driven, often ahead of other countries in the use of technology. In many ways, New York City's past tells a different story—a government plagued for decades by cronyism, problematic housing development, and fragmented planning. While their development paths to the present day have been quite different, both cities have had astounding success in recent times from the point of view of urbanism.

As they continue down their paths to become smart cities, they have much to learn from one another. New York City's multi-stakeholder, practical-minded approach can also appear disjointed and ad-hoc; Singapore's visionary, comprehensive approach can also appear nebulous and removed from the ground. Perhaps greater central coordination would allow New York City to deploy its projects at the speed and scale that Singapore has been able to achieve, while a greater openness from government would help Singapore attain the participation of business and the public that New York City has fostered. In the end, both cities have caught the attention of the international urbanist community because their technology initiatives are guided, above all, by the needs of their citizens.

Contributors

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Anna Ponting was a recent student fellow at the Centre for Liveable Cities. She has worked for the Mayor's Office of the City of New York and as an consultant on international urban policy issues for Bloomberg Associates. She has a Bachelor's in Urban Studies from Stanford University and is currently pursuing a Master's in Public Policy and Master's in Business Administration from Harvard University.

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Acknowledgements

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