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Abstract

This paper foregrounds the importance of underlying territorial formations in realising a vision of the smart city. It argues that as a political technology of the state, territory should be understood as a platform upon which data works and the smart city unfolds. In this view, island territories – of which bordered city-states like Singapore provide paradigmatic examples – provide an integral, yet hitherto unexplored, component in the realisation of urban "smartness". We illustrate these theoretical arguments through an analysis of how the territorial constraints that characterise Singapore's island platform enable the state to accurately and effectively realise its vision of a smart city. As both an island city and a city-state, Singapore's territory is a political technology that is just as important in realising the state's vision of smartness as the adoption of digital technologies and the management of data. Drawing on 27 interviews with 31 architects of Singapore's Smart Nation, we empirically explore the integration of data, city and territory through the platform; the "hardness" of data and the "softness" of the city; and the hyper-terrestrialisation of "smartness" in Singapore. Overall, we demonstrate how the idea of territory as a platform provides a generative counterpoint to critiques of platform urbanism.

Keywords

Platform urbanism, island platforms, territory, smart cities, Singapore.

1. Introduction

Rarely, if ever, have the territorial underpinnings of smart cities been the focus of scholarly analysis. Rather, it is – for reasons that are understandable – the novelties of the digital that are denoted by the "smart" prefix that have caused the territorial assumption of the "urban" or "city" suffix to be neglected. Conceptually speaking, this focus creates an analytical hierarchy whereby "smart" sits on top of "city" and has hitherto dictated the scope and limits of the discourse. Approaching this hierarchy from the perspective of urban theory, however, is dissatisfying for 'the urban is not a pregiven, self-evident reality, condition or form' and 'its specificity can only be delineated in theoretical terms' (Brenner and Schmid 2014: 749). Cities are spatial categories of classification that are indexed to the substrate upon which they are found. The bifurcated hierarchy that smart urbanism discourse reproduces should, therefore, be seen as *trifurcated* along the lines of the digital, the urban/city, and the territorial. How each layer inflects the other/s requires closer exploration. Recent scholarship on platform urbanism, for example, interrogates the first two layers, considering what it means for platforms to be an 'urban phenomenon, but the influence goes both ways: cities are also reshaped by platforms' (Sadowski 2020a: 450). Similarly, ongoing developments in the theorisation of territory interrogate the second and third layers, with the premise that territory is a 'political technology' (Elden 2010: 799) providing the impetus for Painter's (2010: 1090) well-received call for research to consider 'the nature of territory itself – its being and becoming, rather than its consequences and effects'. In this paper we attempt to connect the first layer to the second *and* third through consideration of how the unique characteristics of territorial platforms can mediate how "smartness" comes to permeate the city.

To excavate the theoretical nexus of the city and its territorial underpinnings, we focus our analysis on the island as a distinctive kind of territorial construct. By viewing islands as bordered territorial platforms upon which urban processes unfold, we emphasise the recursive relationship between three distinct, but interoperable constructs: territory, urban space, and the structures of governance responsible for urban management. In the schema of the smart city, data play a mediatory role that cause each construct to inflect upon, and ultimately shape, the other. Indeed, the idea of terrestrial constraint foregrounds the need for higher degrees of spatial flexibility and plasticity. As a guiding heuristic, the idea of island platforms can help extend recent articulations of the city-as-a-platform, which claim to reflect a more "holistic" understanding of smart cities that encapsulates the need 'to optimise the functions of the whole city, not to stop at finding solutions for individual problems' (Hwang 2020: 80). Conceptually, the city-as-a-platform extends the smart city construct horizontally, the aim being to capture and integrate hitherto diverse urban functions and processes into one analytical schema. Island platforms extends this thinking along the vertical plane: upwards to the regimes of governance that leverage data in the pursuit of "smartness", and downwards to the territorial underpinnings of urban space. The idea of the island platform can, then, be seen to underpin visions of what the smart city *should* be, given that the 'smart city strategy is executed as a vision of *spatial integration*; platformed conditions of urbanisation co-opt spatiality, and spatiality as a unit of information, along with everything else' (Barns 2020: 171, emphasis added). By pushing the boundaries of what "integration" can or might mean, we offer insight into the ways in which territory-as-infrastructure can create the conditions through which smartness is realised.

We bring these ideas to life through an analysis of Singapore as a territorially constrained island platform. Singapore's islandness, coupled with its city-stateness, imbue it with a

unique set of physical and administrative characteristics that establish important conditions for the possible realisation of its "smartness". We argue that Singapore's islandness – hereafter recognised as a territorialised assemblage of socio-spatial arrangements – is best understood as a type of "platform" that can be assembled in ways that create new forms of terrestrial value. Given Singapore's compact size[1], terrestrial value is extracted from the premise of territorial constraint. This value manifests materially as greater spatial flexibility, contingency and enclosure (Usher 2020), and is arguably one of the defining characteristics that sets the Singapore case apart from other aquatic islands (Australia, Greenland, the United Kingdom) or archipelagos (Indonesia, Maldives). In this sense, "smallness" correlates closely with the realisation of "smartness" as the island platform creates a high degree of political, terrestrial and technological alignment. In other words, Singapore's compact size means the materiality of the terrestrial becomes more visible and important. It imparts a relatively high(er) degree of pressure on its government to leverage data in ways that unlock the latent value of the terrestrial, causing it to become more flexible, more controlled, and even more volumetric. Thus, whilst territory is a technology of governance and administration, the terrestrial is the material substrate through which the territorial becomes manifest. Given Latour's (2011: 802) observation that the 'more the digital, the more material an activity becomes', data plays an integral role in this realisation. It causes the city to become more-than-human, with terrestrial actors playing a more active and agentic role in the design, development and operationalisation of the city and its processes.

With these ideas in mind, we build on the premise that the contemporary era of data saturation – that is, the data produced by the embedding of sensing, monitoring and tracking technologies throughout the materialities and lived experiences of the urban – or, the "datacene" as we term it, has caused the latent spatial value of territory to become a more

carefully curated construct. Whilst scholars have started to critically explore the drivers and effects of "data colonialism" in and throughout the world (Estrada and Lehuedé 2022; Lehuedé 2022; Tait et al. 2022), the focus has been largely on mapping the terrain of a "new" phase of capitalism in which human experience becomes increasingly datafied. As counterpoint, the territorial underpinnings of the datacene index data to the terrestrial and built environments, causing data to become embedded within the fabric of the city. Just as digital platforms express a preoccupation with 'turning idle resources into maximally productive assets and commodifying latent spaces in existing places' (Sadowski 2020a: 450), these characteristics take on unique forms when understood through the territorial lens of the city. Indeed, whilst Singapore's government has been shown to be effective in integrating 'silo-based services… to produce a collaborative and integrative model' (Joo and Tan 2020: 4) that illustrates that the city undoubtedly *is* a platform (Woods et al. 2023a), we evolve these ideas by foregrounding the unique territorial underpinnings of Singapore's island infrastructure. The platformisation of territory causes the city to become more spatially integrative and interoperable, which in turn gestures towards a new form of data-driven urban futurity that is indexed to the land on which it unfolds. By foregrounding the idea that territory itself is the platform upon which data works, new understandings of the territory-data-sovereignty-state nexus can emerge (after Castells 1977; Brenner and Schmid 2014; Merrifield 2014).

By developing the Singapore case, we consider how the state-city-territory nexus creates the conditions through which urban "smartness" can be realised to a high degree of accuracy and effectiveness. For many years it has been recognised that 'the constructed ground on which [Singapore] stands is constantly shifting, both metaphorically and literally' (Chung and Douglass 2020: 13), with De Koninck (2017) going so far as to suggest that Singapore is

undergoing a "permanent territorial revolution". Whilst assertions like these speak primarily to Singapore's rapid and dramatic urban transformation in its nearly six decades of independence from neighbouring Malaysia, so too do they have a more theoretical resonance that speaks to the island platform upon which these territorial shifts take place. These shifts are set to continue in the datacene, when the developmentalist goals of the state are executed through the ideology of the Smart Nation. Most commonly instantiated and documented in Asia, this developmentalist ethos is associated with an oversized and interventionist state adopting a 'plan-rational approach [to] mobilizing capital and disciplining labor' by 'apply[ing] the most cutting-edge technologies' (Joo 2021: 5, 4). Whilst this ethos can be witnessed throughout the industrialisers of Southeast and East Asia, Singapore is in a unique position to leverage its island platform in ways that consolidate control over, and the extraction of value from, urban space. Not only is it a city-state with a single layer of government, but so too does its small size, lack of natural resources and survivalist ideology make the island platform ripe for political consolidation and extension through the datacene. As we demonstrate below, these processes of consolidation and extension serve to maximise the utility of urban space – what we term its *hyper-terrestrialisation* – in ways that go beyond the abstractions of digital enclosure.

2. The platformisation of territorial "islands"

Recent years have witnessed a coalescence of scholarship around the idea of the island as a particular form of territorialisation. Islands are not just pregiven territorial formations; so too can they be constructed through the establishment of territorially-defined boundaries (Arnall and Kothari 2020). The "island", then, is best understood as a heuristic that can be either *a priori* or *a posteriori* in its becomings. Whilst the empirical focus of this paper – Singapore –

is an aquatic island with a clearly demarcated territorial/terrestrial border, we propose that an island platform can also refer to any other clearly and unambiguously bordered form of settlement or self-contained territorial-political structure. The importance lies in the border, and the boundedness of territory that borders give rise to. Acting on the premise of territorial constraint imbues the island construct with a politico-territorial vibrancy that cannot be replicated through more expansive or less precisely defined territorial constructs. Thus, whilst island platforms like Singapore boast a single layer of governance, the question is what sort of territorial conditions precipitate what sort of governance structure, and what can be learnt from the territory-governance nexus. Island platforms should therefore be understood as territorially bordered constructs upon which politics, data and urban processes, unfold. Indeed, the idea that islands 'exist not in space but as nodes in a matrix of movement' (Ingold 2000: 219) has come to define the relational turn in island studies (Pugh 2016), and has contributed to an embrace of the idea that islands are perhaps the most volatile, and thus most changeable, of territorial constructs. It is this observation that provides the segue to recent theorisations of the platform, and reveals the rich theoretical nexus that emerges from the idea of "island platforms".

Scholarship on platforms has blossomed in recent years, and has considered the platformisation of societies (Van Dijck et al. 2018), governments (Cordella and Paletti 2019; Kim et al. 2022), urban processes (Barns 2020; Sadowski 2020a) and more. The idea of the platform, and the open-ended potential of the technologies that underpin it, has spurred many discourses and manifestations that coalesce and diverge along disciplinary and thematic lines. In this vein, attention has focussed on the 'increasing ubiquity of platform ecosystems in reshaping urban conditions, institutions and actors' and how 'the particular dynamics of platform ecosystems entangle private and public organisations as well as citizens' (Barns

2020: 19). Notwithstanding, our intention in this paper is to foreground territory itself as a connective infrastructure through which more holistic models of platformisation can be forged. Whilst critical scholarship has explored the ways in which processes of platform urbanism are 'provoking serious issues related to the oversight, operation, and ownership of urban services and spaces' (Sadowski 2020a: 448), they rest on several key, and limiting, assumptions. The first is that platforms are privately-run, profit maximising entities. Public or state-led platforms have hitherto been overlooked (cf. Woods et al. 2023b). The second is that platforms often territorialise from the top down, the assumption being that

> the ownership of territory – in the sense of not just constructing and managing a building, but also of the provision of infrastructure and governance – grants technology capital even greater dominion over and data about people, places and processes in the city (Sadowski 2021: 1737).

To evoke the metaphor of layers used to open this paper, platforms typically "territorialise" between the first (data) and second (city) layers, with little consideration for the third (territory). Island platforms reverses this logic, and explores what might be learnt about smart urban forms by recognising the territory itself as a platform that harnesses data to offer a more spatially flexible, efficient and interoperable vision of the urban future. An understanding like this reaches back to a more foundational understanding of platforms as providing a 'structured and enabling environment for technologies, applications or social processes with a potential of smartening up their development' (Anttiroiko 2016: 7). An understanding like this can also reach forward to more progressive ideas of what urban smartness is, or might be. Analysing 116 definitions of the smart city, Hwang (2020: 78) observes how most 'have little, if anything, to do with city-wide platforms' and instead

define it in relation to ‘specific city services or solutions’. Whilst such an understanding paves the way for the conceptualisation of the city-as-a-platform, one which ‘aims to transform a city’s structure itself’ by providing a ‘city-wide common platform for data to flow through, new technologies to deploy and services to combine across individual fields’ (Hwang 2020: 81), it does not go so far as to consider the spatial transformations that platform models of organisation can give rise to. Revealing the horizontalist bias in the city-as-a-platform model, Anttiroiko (2016: 6) also reflects these limitations in the assertion that the city-as-a-platform ‘offers a vision of the full interoperability of interrelated information systems’ and can therefore ‘support and interconnect practically all the digital functionality the city needs’. Reaching down to the terrestrial substrate of cities can overcome these limitations. It can also open up new avenues of theoretical expansion that bring longstanding debates concerning the interplay between state-power, urban space and networked technologies (Castells 1977; Brenner and Schmid 2014; Merrifield 2014), into conversation with the contemporary era of digital technologies and the data saturated urban spaces they give rise to.

The two subsections that follow explore the premises of these ideas. The first builds on the relational turn in island studies to consider how islands themselves can be seen as political technologies of territoriality. The second engages with recent scholarship on platformisation to consider how the datacene has led to the technologization of urban space. Taken together, these subsections provide a theoretical framework for the subsequent empirical section.

2.1 Islands as political technologies

As much as islands are territorial constructs, so too is their territoriality unique in that it is often defined in opposition to an non-terrestrial periphery. This uniqueness affords new opportunities for territory's political cognates – the nation-state and its assertions of sovereignty – to consolidate and express power when the boundaries of each construct overlap (Brenner and Elden 2009a; Painter 2010; Sisson 2021). In this vein, as much as territory is 'not simply an object' but a process that is 'made and remade, shaped and shaping, active and reactive' (Elden 2013: 17), so too is the processual nature of territory amplified when interpreted in an island schema. It is in this sense that islands can be understood as resolutely political technologies that are relational insofar as their spatial value is indexed to their territorial becoming. In Singapore especially, the island is a political technology that is marketized as a platform. Largely a function of its small size, island platforms like Singapore enable political rationalities to permeate ever-more aspects of island life. They *enable* the Singapore state to become more entrepreneurial, progressive, and bold in its governmentality, as they create the preconditions needed for 'the state's strategic deployment of a whole range of calculative political techniques oriented toward the intensification of market relations' (Brenner and Elden 2009b: 363). The territorially-encompassing island-wide reach of technologies of government paradoxically obfuscates the role of the island *itself* as a political technology. As Brenner and Elden (2009a: 227, original emphasis) put it

> the aim is to make it [state space] appear homogeneous, the *same* throughout, organized according to a rationality of the identical and the repetitive that allows the State to introduce its presence, control, and surveillance in the most isolated corners… The relation between "private" interests and the activities of "public" power sometimes involves a collusion, sometimes a collision.

The mechanics and territorial structure of islands creates the preconditions through which this homogeneity can unfold. The dialectic of islands being at once "absolute" (in their non-territoriality) and "relative" (in their territoriality) establishes a context in which 'land scarcity caused by island spatiality subsequently leads to urban densification and powerful agglomeration economies' (Grydehøj 2015a: 429; also Grydehøj 2019). Put another way, as political technologies, islands enable those in power to *create* and *control* space in ways that could not be done in non-island contexts. Given that 'the creation of ground is an economic end in itself' (Grydehøj 2015b: 104), the territorial mediation of how value is reproduced, circulated and harnessed for gain is accentuated in island contexts, and leads to what we describe below as the *hyper*-terrestrialisation of the island platform (Sisson 2021). These characteristics are pronounced amongst island *cities* – as these processes of value circulation are amplified further – and have become more pronounced in the past ten years or so. This is a period of time in which digital technologies have proliferated through the public and private domains, and have caused urban spaces in particular to become data saturated environments. Notwithstanding such proliferation, the critical platform urbanism literature often treats urban space as a static construct, something that is *acted on* by data, rather than something that is assembled through particular regimes of data governance and use. A well-rehearsed example of this is found in Alphabet's Sidewalk Labs project in Toronto, Canada, which involved developing the 'Coord platform to assist cities in the management of 'curb side' services, integrating a range of data sources to capture everything from parking metres, delivery services, ride-sharing services' (Barns 2020: 176). Data is used to realise the 'platforming opportunity' (Barns 2020: 174) that defines any city, and that underpins the technologization of urban space. The island platform is distinct from such articulations in that space is treated as a malleable construct. It is not something simply acted *on*, but is an active agent in the

realisation of technology-mediated urban futurity. This is an idea that has been explored through the idea of "distributed agency" specifically (Odendaal 2022) and the co-constitutive nature of the spaces that platforms give rise to more generally (Aurigi and Odendaal 2020; Stehlin et al. 2020; Rose et al. 2021), the structuring role of territory in shaping these socio-spatial arrangements remains unexplored.

2.2 The datacene and the technologization of urban space

Data saturation, coupled with socio-spatial density, creates the conditions through which digital platforms have come into being. It is the centrality of data to the platform that renders it a tool of governance – whether political, economic, social, or urban – that is otherwise distinct from the territorial forms of governance outlined above. In this sense, the data-centricity of platforms 'point[s] to the changing relationship between technology, capital, and cities' (Sadowski 2020a: 449) in ways that lead to new understandings of ownership, of value, and of participation. Critical scholarship has focussed on the evolution of rentier relations amidst the platformisation of urban space, with the rentier striving to 'turn social interactions and economic transactions into "services" that take place on their platform' and the platform in turn 'becoming a (necessary) intermediary in the production, circulation, or consumption process' (Sadowski 2020a: 451). This intermediary role grants the platform – or its owners and operators – outsized control in splintering the idea of ownership into increasingly fragmented parts. The micro-enclosure of everyday (digitally dependent) "things" – which itself is the organising principle of the IoT – relies on the software licence which 'allows the new rentiers to claim ownership over the software embedded in, and data emanating from, increasingly more physical things that we use in our daily lives' (Sadowski 2020b: 572). Put differently, the constant circulation of data between objects – a smartphone,

sensor, television, voice activated speaker, and so on – and platforms serves to blur the boundary between the material and the immaterial, thus giving rise to new spaces and new forms of socio-consumptive nudging. It is these effects – which reflect, fundamentally, the *agency* of platforms in the socio-spatial metabolism of the city – that underpin the discursive thrust of the platform urbanism literature.

Platformisation is sometimes thought of as predatory insofar as it can be private sector driven. Moreover, its technological novelty means that the technology companies establishing and running platforms are often un(der)regulated. These characteristics have underpinned critiques of the platform for 'trying to take control over the *operation* of the services that are essential to the functioning of urban society and life' (Sadowski 2021: 1736, original emphasis). For these reasons, combined with the scale at which they operate, they have been cast as 'antagonistic to government policies and incumbent industries' (Sadowski 2021: 1736). Our contention, however, is that criticism of the platform model – especially in relation to the smart city – has become so vociferous that it runs the risk of being blinded to alternative forms of platformisation, or even the *generative* effects of platforms in creating new opportunities for socio-spatial urban becoming. More balanced are the views that 'the smart city and the data that fuels its dreams advance pronounced political transformations' (Luque-Ayala and Maia 2019: 452) and that 'the urban geography of the platform as a flexible spatial arrangement indicates that platforms can hold much promise for the organization of cities' (Richardson 2020: 460). In order to do so, however, a 'more equitable distribution of the value generated by coordination of urban actors is required, *one that lies outside of*… the platform as company' (Richardson 2020: 460, emphasis added; see also Woods et al. 2023b). Richardson's (2020) intervention is helpful as a way of reframing the debate, as it focusses attention on how platforms can foreground the emergence of more

flexible spatial arrangements that rely on data-driven networked urbanism in order to be realised. Ideas like these can be extended by inverting the assumption that platforms are digital-first and exploring what digital augmentation might mean for *territorially-defined* platforms.

Assertions like these also pave the way for more open-ended, and perhaps efficacious, visions of the smart city. A basic premise of the smart city is that 'without… common platforms, it becomes very difficult and costly to develop smart services, because each service then needs to build its own infrastructure' (Hwang 2020: 78). Articulations of the city-as-a-platform cast it as a common data repository that transcends any individual public service, project or stakeholder. It is inclusive, integrative and interoperative in its organisation and effects. The problem with this understanding, however, is that whilst it makes conceptual sense, it often fails to materialise in reality. Data remains siloed, the private sector remains dominant and exploitative, and the city often falls short of both its platform *and* smart visioning. The question is why. One immediate answer is the structure and operation of governance frameworks that are responsible for operationalizing the smart city. Messy and fragmented governance structures often lead to messy and fragmented models of urban organisation and data management. Accordingly, scholarly attention has tended to focus on how 'the proliferation of data-driven platforms is today demanding that governments play a much more active role in the management of their cities' data assets' (Barns 2020: 172). Again, this makes conceptual sense, but it also raises the question of why such "active management" of data is so hard to achieve in practice. The answer we offer lies in the territorial substrate that underpins governance frameworks, and how island territories in particular give rise to modalities of governance that often transcend the city itself. That is, the idea of territorial constraint that defines islands can cause governance models to become more integrated, and

thus effective. As platform, the city does not necessarily foreground good governance practices, whilst the city-as-an-*island* platform potentially does.

3. The technological underpinnings of Singapore's islandness

Singapore is an island city-state in both natural/territorial and constructed/technological ways, each of which has coalesced to the point of indistinction. Whilst the islandness of Singapore is indisputable, the *type* of island it has become has changed over the years. According to De Koninck (2020), in 1957 Singapore's land mass covered 581 square kilometres. Today it is just under 730 square kilometres, which gestures to the physical expansion of territory through decades of reclamation. Beyond such physical expansion at the behest of the state, so too have the enclosures of the ocean caused territory to be imbued with resolutely flexible, adaptable and ideological meanings. Singapore's built environment 'continue[s] to be redesigned and upgraded when not overhauled or even eradicated' (De Koninck 2020: 94) to the point that, today, Singapore is 'characterized by its distinctive concentration of vertiginous architectural icons in the downtown… bounded by the swathes of verdure increasingly integrating with the expansive residential estates infilled with uniform public housing blocks' (Chung and Douglass 2020: 13). As much as Singapore's landmass is growing, so too does its island status foreground a fundamental reimagination of the idea of spatial fixity. In this vein, Chung and Douglass (2020: 11) argue that Singapore is a "soft" – that is, always subject to change – city as 'physical spaces are subject to a multitude of social imagining, which are then projected back into urban space to convey individual and shared meanings, identities and purposes'. Building on this sentiment, De Koninck (2020: 104) outlines the political underpinnings of this dynamic, as Singapore's

> permanent territorial revolution… [should] be considered an instrumental yet fundamental factor: a tool of social management, control and political discipline. The Singapore population lives on a movable and rolling territory: the carpet on which people stand, so to speak, is constantly being displaced, or even pulled from under their feet.

The bigger idea behind this "instrumental" understanding is that territory is used as a technology of political consolidation. Its orchestrations enable – and have enabled for many decades now – the consolidation of political power. As De Koninck (2020: 104) goes on to suggest:

> Spatial security exists at only one level, one scale: those of the state in its territorial form… Singapore population's adhesion to the Republican project is linked to the permanent spatial insecurity, internal and external, real or only perceived, that characterizes the nation.

At this juncture we can begin to appreciate how Singapore's islandness has come to shape its political structure, and in turn how its political structure renders the island geography of Singapore a resolutely technological construct. This "technology" of islandness is wide-ranging, and includes the mechanics of territory (through land reclamation, for example), terrestrial policies (concerning land zoning, housing, politico-administrative boundaries, and so on), and most recently the role of data in rendering Singapore's landmass "knowable" and thus "controllable" to hitherto unprecedented degrees. Enabling this technologization is Singapore's political structure, which includes a single layer of governance that spans the city-territory-nation, meaning that 'pathways to implementing national policies and

programmes are direct and largely unhindered, as central government is spared from having to go through multiple levels of subnational approvals' (Chung and Douglass 2020: 13). Whilst this has caused the Singapore government to be labelled "managerialist", and even "authoritarian" (Hoe 2016; after George 2007; Ortmann 2011; Tan 2012), so too has it enabled it to successfully adopt a technocratic disposition to tackling a number of strategic challenges facing the country. In many respects, the particular ethos of the Singapore state is one that has, over many decades of rule, created a political climate in which policies can be formulated and implemented with a speed, effectiveness and developmentalist logic that is not found in many other urban contexts. In 2014, this technocratic disposition came to the forefront of the policy agenda – and the public's notice – with the launch of Singapore's smart city initiative, labelled the Smart Nation. Yet, the technological underpinnings of Singapore's islandness have caused others to suggest that 'Singapore was technically *already* a smart city' (Joo 2016: 6-7, emphasis added) that boasted a number of forms of technological augmentation designed to improve the quality of life for residents. What the Smart Nation did usher in was a bureaucratic reorganisation, with two agencies – the Smart Nation and Digital Government Office (SNDGO) and GovTech (the technical implementation arm of the government) – being formed to implement various initiatives according to a "whole-of-government" approach (Hoe 2016; Joo 2021; Kong and Woods 2018).

Whilst this approach is enabled by the fact that Singapore is a city-state, so too does it cause the government's territorial control to become more fine-grained and exacting. Smart Nation projects have involved 'developing an entire ecosystem supported by infrastructure, technologies, policies, culture and capabilities' (Hoe 2016: 327) that is geared towards greater efficiency, productivity and liveability. We can begin to see the territorial mappings

of the Smart Nation – few other cities in the world can speak of being a smart "nation" as their purview is more localised – and how this might lead us to rethink Singapore's islandness as a digital augmented platform from which new spatial arrangements might unfold. As Joo (2021: 9) puts it, the 'Smart Nation seeks to develop a collaborative ecosystem that engages citizens and improves their lives around the Smart Nation platform'. Yet, our contention is that the "Smart Nation platform" is not just the digital infrastructure that enables data to be generated, analysed and acted upon at a scale and speed never before seen, but so too is it the territorial infrastructure – the island – that *enables* the digital infrastructure to work as it does. This is a territorial infrastructure that lends itself to a single layer of government, to a whole-of-government (and indeed whole-of-nation) approach, and to highly coordinated and integrative digital solutions. It is also an infrastructure that renders the Singapore case resolutely unique, and so difficult to replicate in other contexts (see Woods and Kong 2017; Kong and Woods 2021). The territorial infrastructure that underpins the island platform enables 'densification' to emerge from the fact that 'agglomeration processes feed upon themselves' thus leading to 'spatially dense networks of industry, infrastructure, and knowledge' (Grydehøj 2014: 186). In this vein the Singapore case can yield insight into the role of platforms in shaping new urban futures.

4. The hyper-terrestrialisation of Singapore's smart city-state

The subsections that follow draw on qualitative data generated through in-depth interviews with (mostly senior) stakeholders representing the public sector that have been responsible for implementing the Smart Nation vision, as well as leaders in the private sector seeking to digitally transform their organisations. Fieldwork started in April 2021, and continued until April 2022. In total, 27 interviews with 31 stakeholders were conducted. The public sector

organisations that we sampled included GovTech and SNDGO, ministries like the Ministry of Defence, Foreign Affairs and Home Affairs, and statutory boards like the Housing and Development Board and the Land Transport Authority. The private sector organisations we sampled included the Development Bank of Singapore (DBS), Singapore Technologies Engineering, Starhub (a local telco) and Huawei International. Important to note is the seniority of many of our interviewees, which included CXOs, Permanent Secretaries, Managing Directors, Directors of divisions and Group Heads. For some organisations – like GovTech – we also sampled more junior employees such as Associate Data Scientists, Associate Cybersecurity Specialists, and Software Engineers. Not captured were the voices of everyday citizens or end-users of the platforms developed by the state. Because this project is part of a global comparative study of smart city development, our sampling focus was on policymakers and the producers of smart city platforms. Notwithstanding, a separate, user-centric follow-up study nonetheless provides a compelling opportunity for further research.

Many of the interviewees were conducted by all authors, and most were conducted by at least two. All interviews were audio recorded after informed consent was obtained, fully transcribed, and then sent to the interviewee to edit for factual accuracy, redact any sensitive content, and ultimately approve for publication. Given the seniority of most interviewees, they were also given the option to be named personally, to be identified as representatives of their organisation, or to be anonymised. What this gave us was a rich dataset that offers unprecedented insight into the architects of the Singapore Smart Nation initiative. Specific to this article, it provides unique insight that opened possibilities for examining the platformisation of Singapore as an island city-state.

4.1 Integrating data, city, and territory through the platform

Singapore's islandness lends itself to centripetal processes of integration and agglomeration. Territory, the city, and data become integrated through the island platform. These integrative processes occur both horizontally and vertically. Horizontally, Singapore's small size lends itself to socio-spatial agglomeration, which reflects the fact that 'cities are at their most city-like (densest) when circumscribed by water' (Grydehøj 2015a: 434). Vertically, its single layer of government and city-*state* status, causes the Smart Nation to be "one big initiative, and the government is leading it", as Raof Latiff, the Managing Director of DBS's Institutional Banking Group, told us. Similarly, Johnny Wong, the Deputy CEO (Building) at the Housing and Development Board – Singapore's public housing agency – shared how "we are small and our government agencies are close-knitted. We push ourselves to work together". This sentiment was reiterated by a senior representative of one of Singapore's statutory boards, who told us that "in Singapore, the infrastructure agencies do come together a lot to integrate our plans well in a way that optimises things and systems". Hwang Yu-Ning, formerly the Chief Planner of the Urban Redevelopment Authority explained further how:

> The value of planning is in the exercise of planning, not the plan itself. The plan itself may serve as a blueprint on some levels, but it is the exercise of planning, the process of planning, that in Singapore's case we bring the different stakeholders together, we have a conversation about what is working now, what is not working now, what do we anticipate for the future, what are some of the unfolding trends.

The value of the plan is that it brings together stakeholders from different branches of government to discuss and agree on issues that could impact upon Singapore's urban future.

Prioritising integration, sentiment like this suggests that Singapore is always-already planned; or, the premise of territorial constraint foregrounds an approach to planning urban space that is pre-calculative, and indexed to future value creation. Characteristics like these define Singapore as a smart city. For example, Ng Chee Khern, Permanent Secretary of SNDGO, told us how "when I talk to other countries… I have difficulties understanding how people navigate three, four, five layers of government, and how responsibilities and power are spread out into these different levels of government", whilst Raof jokingly opined that other countries are better off "start[ing] from scratch" by "starting up a whole new city". The logic underpinning Raof's opinion is that it is easier to centralise a city's data infrastructure – and thus circumvent the problem of data siloes – by starting from scratch rather than trying to integrate legacy systems. The fact that Singapore itself managed to integrate such legacy systems is testament to its unique model of governance.

Whilst Singapore has been able to do this through government restructuring – and the centralisation of its Smart Nation efforts within SNDGO and GovTech – this is an organisational fix that could only work through a well-aligned territory-city-state apparatus. It is in this sense that territory is a good lens to 'examin[e] the relationship between digital urbanism, space and power' (Luque-Ayala and Maia 2019: 454; after Painter 2010) and the associated sovereignty of the state's decision-making capacity when it comes to urban development. Indeed, whilst the data-led nature of the smart city has caused the idea of sovereignty to be 'applied in much wider and looser ways, which also account for the relationships of governance and geography' (Sadowski 2021: 1739), so too do the terrestrial limits of Singapore's islandness cause it to remain a resolutely grounded construct. A senior public official working in a government ministry put it well in his rationalisation as to why this relationship is so effective:

> We are a city and a state, and an island at the same time… the city's compactness allows us to implement with a great deal of dexterity compared to a system that is more sprawling or which has multiple jurisdictions overlapping and coalescing within a single space.

Important is the foregrounding of the city – and more than that, a territorially constrained *island* city – in shaping the ways in which the government harnesses the digital for the benefit of the nation. According to the official, this grants the government a high degree of "dexterity" in implementing solutions, which is indexed to its territorial uniqueness and a point of contrast to many other cities around the world. It is at this point that we can begin to see the value of the island as a platform. Island platforms reflect a return to the idea that 'platforms were essentially physical sites, yet due to technological development they have become increasingly digital, dispersed and delocalized' (Anttiroiko 2016: 7). Contrary to this sentiment, the island as a platform enables Singapore's smart city to become concentrated and resolutely "localised" around the organising principles of implementing effective solutions. The island itself can be understood as a "national platform" that allows Singapore to have "national capability centres" in areas such as digital services, data science and AI, sensors and IoT, government infrastructure, and cybersecurity, as Kok Ping Soon, the CEO of GovTech, told us. These national platforms offer digital services – and include things like Singpass (a digital identity service), LifeSG, the Smart Nation Sensor Platform, SG Stack, and more – that are enabled by the enclosure of, but also fine-grained manipulation of, territory. Indeed, the *importance* of the island is to actually recognise the importance of geography in realising the promises of smartness. As much as "the whole geographical barrier goes away" (Raof) with digital services, so too does the island platform reify it in

ways that open up new avenues of value creation. These avenues are indexed to how space is simultaneously constrained by the island platform, but also infused with more flexible and malleable use patterns through digital mediation.

4.2 Hard data, soft city

Within the architecture and urban design literatures, interest has started to coalesce around the idea of how cities – and the spaces they occupy and reproduce – can become more flexible constructs that are able to evolve to suit myriad external factors. This flexibility underpins the idea of the "soft" city – one that might be fixed in place and material form, but is nonetheless flexible in its usage and reproduction of space therein. Softness reflects a new paradigm of governance and control, in that 'being in control means being able to respond appropriately at a particular moment and in a particular situation, and that response is not always going to be the same' (Sim 2019: 209). Indeed, the notion of "flexible spaces" offers a vision of 'reconfigurable, rotating, non-permanent, non-exclusive forms of land use that enable a broad range of spatial experiments' (Carr and Dionisio 2017: 74) to be enacted. These ideas are largely a response to the datacene, with data saturation causing cities to become more knowable, which in turn imbues them with the *potential* to be "soft". It is in this vein that Sim (2019: 4) suggests that the soft city be seen as the 'counterpoint or even complement to [the] "smart" city', with "smartness" here being indexed to the use of digital technologies to solve urban problems. However, where Sim (2019: 4) sees "softness" as a bottom-up, citizen-led movement that works best if it involves 'simple, small-scale, low-tech, low-cost, human-centered, gentle solutions', the spatial constraints of the island platform causes the idea of "softness" to be indexed to smartness, not alternative "low-tech" solutions. Accordingly, in the schema of the island platform, smartness is a precondition for softness to

unfold as it provides the visibility needed for spatial value to be maximised. As Yu-Ning told us:

> There is more data to support evidence-led type of planning. For Singapore's planning in the past, we planned regional business or job centres like Tampines, Changi Business Park, to decentralise from the CBD, to create job options near where people live, hoping that people can live, work and play near where they are so as to reduce commutes. On a conceptual level, that seems to make sense. But in the past, we did not have the data to see whether it is really working or not, that the people working in these regional locations are indeed residents nearby. But now we do. We are able to, say, go behind the EZ-link data and look at, at an aggregate level, the origin and destination of the commuters.

Whilst city spaces are malleable and thus "soft", data are immutable and thus "hard" in their circulations and effects. Data do not change, even if they can be interpreted differently, and therefore used, in Yu-Ning's words, to "sharpen the plan". In Singapore, the hardness of data complements what has previously been described as the "hard" state, with the datafication of space rendering the state's governing authority more absolute, more precise, and more complete. As an island platform, this complementarity is important. As the senior public official explained, being a "tiny" island is "where the land use and the constraints come in" as "there are very significant trade-offs that we have to make… we don't have the luxury, for instance, of our industries being far away from residential areas, so then tech becomes important there, right?" The importance of tech in this regard is that it can help the state manage the "disamenities" that arise from the spatial clustering of otherwise distinct – and perhaps mutually non-compatible – land uses. Data enable the magnitude of (potential)

problems to be measured and solutions developed, with the island platform going a long way to addressing the perennial problem of 'how the fast temporal scale of big data can be reconciled with slow dynamics of the socio-spatial organisation of cities' (Kandt and Batty 2021: 2). The point is that the island platform speeds up the socio-spatial organisation of cities, rendering them *faster* and more *controllable* constructs. The hardness of data, coupled with the hardness of the state, coupled with the softness of urban space, enables this. This provides a radical reimagination of the view that 'space, in its commodity form as land, is seen as immutable, fixed in both location and quantity' (Sadowski 2020a: 448), with the island platform hardening the data, softening the city, and thus reimagining the spaces of urban possibility. As the public official went on to explain:

> I think a lot of that comes from being an island, actually, because the fact is we don't have space. We can reclaim, as we have done, and I think we have done a pretty good job at that, but there is going to be a limit to how much we can reclaim.

Territorial constraint increases the pressure to maximise the value of urban space, and thus foregrounds the need for the city to be soft and malleable. Critical scholarship laments the fact that platform urbanism provides 'new ways to capture value and control property' (Sadowski 2020b: 563). Assumed is the fact that capture and control leads to exploitative, and thus negative, consequences. Island platforms, however, are based on the irreducible *premise* of capture and control, meaning any perceived negativity is built into the construct itself. The senior public official initially shared the ongoing desire to "grow the data pie" and in doing so to "create use cases of data applications" to ensure that it could be harnessed and operationalised by different stakeholders. Subsequently, he reflected how "a lot of it actually boils down to making sure that we try… that the government is fundamentally motivated by

creating some kind of public value". The use of data to create new forms of value might easily be interpreted as a guise through which state co-optation can play out. In China, for example, the creation of a Social Credit System (SCS) that 'manage[s], monitor[s] and predict[s] the trustworthiness of citizens, firms, organisations and governments' has been enabled by 'centralising data platforms into a big data-enabled surveillance infrastructure' (Barns 2020: 175). Whilst platformisation increases the capacity for state overreach to be realised, it also creates the conditions through which new forms of data-derived value can be extracted from urban space.

Platformisation sparks new forms of urban becoming through datafication, thus unlocking the value within, urban space. In Singapore, datafication enables state actors to 'mak[e] more [space], more quickly, in more ways, while also deriving more types of value from it' (Sadowski 2020a: 448). Whilst Sadowski makes these observations in relation to capital exploitation, so too can they be used to optimise the city. Yu-Ning told us how "excited" her organisation is about the potential of hard data to lead to new forms of "plan optimisation" when it comes to urban planning:

> Today, we have planning norms, like providing 8 square metres of park space per resident and locating parks within 400 metres [of residential areas]. So imagine you can codify each of these for the different land uses, then I give you the base plan of where the vacant land is for a certain tenure. So can the optimisation tool suggest to me the options of where these new parks should be placed and what are the trade-offs between the options? Then what gets more interesting is can it also look further in the future: if I locate this here, am I locking my options for the future?

Under conditions of spatial constraint, the need to – and value of – embedding optionality into urban planning can lead to more calculable, and thus effective, spaces. The platform is set up to overcome the constraints endemic to the island construct, and the softer the city can be, the more efficacious it can be for its stakeholders. As the senior public official explained:

> If you use an economics term, we are operating within the production possibilities frontier. But we are increasingly going against the boundaries of that, which means that once you are there, if you stay on the curve, you either make trade-offs or you push the curve out through digital transformation. The first involves painful current choices. The second involves a painful transformation because it is never easy to move a population into the new needs that it might have.

Hard data enables government stakeholders to "go against the boundaries" of constraint and to push the potential of space to new extremes. It involves leveraging the latent value of the island as an assemblage in ways that are hitherto unheard of. It causes the volatility of the assemblage to be harnessed in ways that create value from uncertainty and instability, through the use of data. As Pugh (2016: 1042) puts it in relation to the assembling of islands, 'assemblages are never stable because they are *effects* of force relations brought into relation with each other in a particular way, which can always be potentially reconfigured in different ways'. Hard data increases this potential massively, whilst simultaneously causing reconfiguration to be a source of value rather than risk. The official evoked an example to help explain this value: "in ten years, will we have to choose between building a hospital or building a school if we don't have the space to build both?" He went on to explain how "at the moment, hospitals and schools have to be separate things, but I wonder if the use of tech and the creative use of space can actually help us to do both at the same time?" Technology

here provides opportunities to reduce the need to make trade-offs and increase the potential for spaces to be created that are built on the *premise* of flexibility. He went on to elaborate the need to "find dual use natures for some of these spaces, and then allow technology to help us govern those spaces in a lot better ways". Rather than soft cities and hard data being seen as oppositional constructs, hard data are the very building blocks of "softness". Or, in other words, the maximal realisation of "smartness" foregrounds the maximal realisation of "softness" as well. The city is not just territorialised through the use of data, but data also become hyper-terrestrialised.

4.3 The hyper-terrestrialisation of "smartness"

A critical barrier that prevents the realisation of the smart city in many (if not most) contexts around the world is the difficulty in harnessing data to effect change. There is a disconnect between the volumes of data that are collected and the (in)ability of governments to use them to realise their visions of what "smartness" is, or might be. For data to be harnessed effectively, they need to be terrestrialised: that is, embedded within the material realities of the city. Island platforms like Singapore, by necessity of spatial enclosure, force data to become *hyper*-terrestrialised as the pressure to maximise the utility of space, coupled with the outsized political control that comes from Singapore being a city-state, is amplified. As the senior public official explained:

> We have quite significant choices that we have to make… We don't have that luxury [of space], which means the entire city becomes a very urbanely inflected space. It is important for us to remember… that we don't have the degree of freedom that larger

> polities have. And I do think that simple things like land use choices become really critical for us.

The territorial constraints of island platforms cause them to become all-encompassing in scope. Not only do they enhance the value of space, but so too do they foreground the value of society as a spatially defined construct. In other words, the vision of the smart city needs to be realised holistically if it is to be effective. Understandings like this gesture towards a more expansive understanding of "hardware" that goes beyond the materiality of technology – sensors, smartphones, cameras, and so on – and seeks to understand how these technologies are embedded within, and respond to, the broader socio-spatial contexts in which they are operationalised. In other words, whilst the idea of urban hardware might often be associated with the built environment and its datafication through sensing, so too might it usefully be analytically extended downwards to include the terrestrial substrate upon which urban processes of socio-spatial reproduction unfold. To realise smartness, such terrestrially-situated hardware must be integrated with data-channelling software. Put another way, the hardness of data must be integrated into the softness of the city if the spatial flexibility of the island platform is to be realised. Chee Khern told us the challenges of realising these forms of integration:

> To be a digital government, in many ways it is easier if electrons are physically un-situated… [For] the Smart Nation part, the digital and software have to be embedded into hardware, where the hardware has to be geographically situated, embedded into infrastructure, [it] has been a lot more difficult. A product's life cycle is longer, planning cycles are longer. I think just the pure amount of money/investment is much

> larger in this sort of big physical infrastructure, incorporating smartness as compared to digital systems.

What Chee Khern emphasises here is the scale of transformation that is needed to render a city smart. It is not just about installing a layer of digital measurement on the surface of the city, but about making sure that the digital is embedded within the very fabric of the city. This is an expensive and time consuming project that draws a clear distinction between "incorporating smartness as compared to digital systems". Incorporating smartness into the terrestrialised hardware of the city renders it not an abstract idea but a hyper-localised part of the city (Leszczynski 2019). The difficulty of – but also the clear need to – do so effectively was a preoccupation of many of our interviewees. For example, the senior leader of a statutory board told us how, in order to "build stronger communities on the ground" they are "thinking a lot more about the software portion – how hardware interacts with surrounding communities". Yu-Ning echoed this sentiment with regards to the URA, sharing how there is a focus on figuring out "how do we integrate the cyber and physical aspects together". She went on to provide a specific example of how they might go about ensuring that the use of service robots is as effective as possible. These robots are helpful in "supporting certain Smart Nation initiatives, say e-commerce, digital payments, contact-free delivery", but the important point is that they "also have a physical presence in our physical infrastructure, and we need to consider if the service robots are sufficiently supported by the urban infrastructure in their movement – can they navigate and communicate with the city? So there is an interconnection… like Smart Nation equals smart city [in Singapore]" This need for integration is a defining feature of the island platform, and causes the smart city to become terrestrialised, grounded, and thus *real*.

Assertions like these go some way to offering a vision of how platforms *can* work. Given the view that a 'platform is not designed to complete any specific task; instead, it helps other products to provide services easily and in an improved manner' (Hwang 2020: 85), the island as a platform enables smartness to be realised through the logic of terrestrialisation. This is a logic that forces the integration of space, of governance and of visions of "smartness" through one structuring force. It is this defining territorial feature that sets the Smart Nation apart, and creates the features through which integration and centralisation can unfold. As Chee Khern explained, the restructuring of government, of physical infrastructure, and of public services is based on the "integration of data at the backend, [and] the integration of digital infrastructure in the backend, [so] we can service citizens in a much more integrated manner". As much as criticism of the platform generally rests on its ability to 'insert itself into spaces, things, and interactions… in order to control access and capture value' (Sadowski 2020b: 564), the island platform creates the preconditions through which these processes of value creation are for public, more than private, good.

This dynamic is clearly observable in Singapore's public housing estates. In Singapore more than 80% of its population lives in public housing that is built and managed by the Housing Development Board (HDB). In the process of evolving the built infrastructure of the HDB to suit the realisation of the Smart Nation, a clear line is drawn between the public and private good. As Johnny Wong, the Deputy CEO (Building) of the HDB told us:

> It is easy for HDB to come in and put the infrastructure, work with the Town Council to introduce a lot of smart stuff. Smart lighting, smart pumps, smart lifts… Those are very easy. But there is also what you call a unit-level that is at the residential space. Now, for that, HDB has always been very careful. A lot of vendors and suppliers

> come to us… but we have always resisted. And so, we thought that the way we interfere should be, we should lay the necessary infrastructure to allow them to adopt smart solutions easily… We call it smart-enabled homes.

What Johnny describes here is the relative "ease" with which he is able to implement smart solutions that serve a public good. These are solutions that are resolutely located in the public spaces of the HDB estate, and are therefore part of the larger-scale infrastructural upgrading works described earlier. Where this upgrading becomes more difficult, however, is within the private space of the home. Whilst private sector "vendors and suppliers" push the HDB to install their products – like smart curtains, or refrigerators, or entry systems – in newly built flats, the HDB resists such interference. Instead, they remain concerned with the infrastructural level, and ensuring that every new flat is created in a way that it can be adapted to *become* as smart as the owner or resident wants it to be. This involves, for example, installing fibre points within each flat so that the speed of internet connectivity does not become a point of community division. What this also reveals, however, is a realisation of smartness that is terrestrialised through its embedding within the material infrastructures – in this case the HDB estate – of the island platform. Taking these ideas further, the public official described the everyday realities of realising a vision of smartness by illustrating the issue of "whether countries and citizens have the wherewithal to play in the digital space. Do they have the devices, laptops, phones, iPads?" before going on to share how, in Singapore, "the government can fund them a hundred percent, but if it is possible, we ask them to co-pay a little bit of it so they have skin in the game as well". Whilst it is a vision that is unique and idiosyncratic to Singapore, understanding the island as a platform can yield a more expansive understanding of the platformisation of cities, and their role in creating more efficient and idealised urban futures. The terrestrialisation of data through the centralised governance of

the city-state is a key aspect of such futures, and offers a new way of understanding both the territorialisation, and also the technologization of governance in the contemporary world.

5. Conclusions

Whilst the Singapore case is unique, the idea of the territorial platform holds theoretical value that transcends the idiosyncrasies of context. Foremost is that it provides a novel position from which a critique of the platform urbanism literature can unfold. As Richardson (2020: 460) observes, the 'urban platform requires an approach to critique that necessarily retains some of the "structural" elements that are sometimes found wanting in post-structural approaches to the city'. As the substrate of any sense of urban becoming, the idea of territory – and, in the island schema, the more specific idea of the *terrestrial* – provides an undeniable structure that might prove to be generative if foregrounded in both the platform and smart urbanism literatures. In the Singapore case, the relationship between the island platform and the country's ongoing economic development – and indeed resilience – is needed in order to evolve understandings of the developmentalist Asian city to suit the unique contingencies of the datacene. The datacene underpins a transformation of the relationship between the digital and the urban worlds. Bringing these ideas into conversation with each other, Luque-Ayala and Maia (2019: 450) argue that 'in the interface between digital and urban worlds, territory as a political space is constructed through economic incorporation – [thus] advancing a configuration of politics that is likely to increase in importance in years to come'. More balanced understandings of not just the exploitative potential of platforms, but their beneficial value as well, are needed to bring these configurations to life (after Lee et al. 2020; Woods 2020; Hanakata and Bignami 2023). In this regard, the Singapore case provides a valuable starting point for the recalibration of possibility amidst widespread platformisation.

Endnotes

1. Singapore's landmass is approximately 730km^2.

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