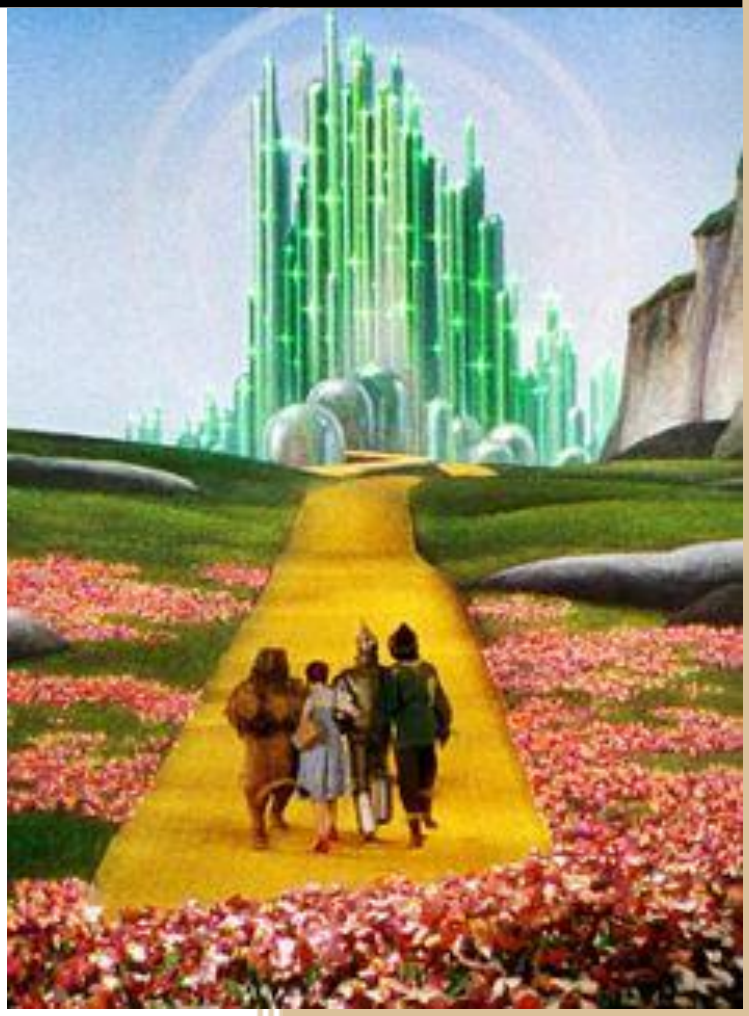
EoT: Energy of Things

Governance and the Smart City



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GOVERNANCE AND THE SMART CITY

KEY INSIGHTS:

- Genuine governance in a mature Smart City is not about codes, standards, rules or protocols - but enshrined legislation.

- Smart City legislation that recognizes the rights of citizens before all the stakeholder groups is vital.

- The historical IP lock-in practices of Smart City vendors is being rapidly replaced with open platforms and software.

- Data produced by the Smart City will have exceptional commercial value. It requires government to recognise this and build an equitable ecosystem where all stakeholders have agency to engage equally in the opportunities this ecosystem affords.

- Despite any definition of the Smart City being skewed according to the self-interests of its stakeholders, it has become an institutionalised policy initiative of all governments.

- Both Barcelona and New York are the best examples of relevant Smart City systems in action: Barcelona's success is informed by EU oversight whilst New York's is increasingly shaped by the private sector.

INTRODUCTION

Outwardly the paradox is acute. The nomenclature of the Smart City - data, code and algorithms - is precise but the definitions, applications and outcomes are varied and imperfect. Yet, fundamentally, there is no contradiction. What is being reflected is that there are competing constructs of the Smart City representing competing visions of society itself and who holds the power in that society.[1] Politics and religion have historically seized on the image of the city as "The Light on The Hill" to promote that their belief systems will deliver citizens an aspirational, safe and inclusive environment in which to live. Today, an IBM or a Cisco would claim to be that "light" (with all the proprietorial rights attached). Their appearance signifies seismic disruptive forces reconfiguring the old-world order. The exponential growth in new technologies and urbanization are profound, and this has bought into sharp relief the dilemma of governments planning for a city future where, as one observer wryly declared, "The internet eats everything!".[2]

Certainly, the Smart City movement initially thought it was best placed to shape urban environments. While "governance by code" maybe an exaggeration, their solutions for the cities they selected to partner with, were imbued by neo-liberal entrepreneurialism.[3] Thus, the IoT inspired programs and policies they have promulgated, coalesce around quantifiable civic services but remain largely silent in addressing urban challenges such as access, inequality or poverty.[4]

This has led a number of critics of the Smart City to accuse it of being elitist. Yet this criticism is as much a fault of cities themselves who, post-GFC, welcomed both the capital and branding vendor ICT the engineering organisations offered. However, the last two years has seen a number of governments re-assert their authority in treating with urbanization and disruptive technology. There is growing recognition that, put in perspective, the success of Smart City initiatives is based on understanding that solutions "are about 10% technology and 90% sociology." [5]

In short, what the Barcelona, New York, Boston, London and Amsterdam Smart City "experiences" highlight, is that while it may be about data (its generation, curation and use), it's their application of it, in their respective urban environments, which is of core value. The American and European response to data strategy and ownership is a function of their different notions of governance. A more granular examination reveals they have different conceptions of privacy and its' regulations. European governments also have a greater desire to "export" their data regimes.

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[1] Poole. S "The Truth about Smart Cities: "In the end they will destroy democracy" The Guardian, 17/12/14.

[2] Sterling.B "Augmented reality: The Internet Eats Everything It Touches" Wired. 2/10/10. And while there are dozens of definitions of Smart City one more balanced than numerous others is preferred by the British Standards Institution:" The effective intergration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens."

[3] Hollands.R "Critical Interventions in The Corporate Smart City." Cambridge Journal of Regions, Economy and Society. No 8 (1), P67. 2015.

[4] Data. A "Three big challenges for smart cities and how to solve them" The Conversation, 10/6/16

[5] Levin.B "The Gigabit Summit" Speaker" January 14th 2015

This critical review of city data ecosystems analyses the genesis, evolving practices, stakeholders and benefits derived from this discourse and argues that while the moniker “Smart City” may be overhyped, there are genuine insights the State of Victoria can apply to its own data governance structure, keyed primarily around community engagement and citizen relevance. Table 1 provides an overview of the five cities reviewed in this exercise, the activities they have initiated and the international standards body classifications they have adopted.

TABLE 1: Smart cities: Base profiles

Smart City	Key statistics	Areas	On-line presence	International standards adopted
Barcelona	– Population 1.6m (2015) – Second largest city in Spain – Population density of 16,000/km^2 – Average age 44 years	– Energy – Public health – Social services – Research – Tourism	– City open data portal – Barcelona municipality – Smart city project – eGovernment – Open government	– ISO*, IEC*, ITU*, IEEE*, CEN-CENELEC*
New York	– Population 8.6m (2016) – Largest city in the USA – Population density of 27,000/km^2 – Average age 39 years	– Urban redevelopment (Hudson Yards) – Education – Computer science – Telecommunications	– NYC open data – City of New York portal – New York Government portal	– ISO, ITU, IEEE
Boston	– Population 667k (2016) – 23rd largest city in the USA – Population density of 5,344/km^2 – Average age 31 years	– Energy – Waste Water – Education – Transport – Data services	– Open Government Boston portal – City of Boston portal – Massachusetts big data portal	– ISG, ITU, IEEE
London	– Population 8.5m (2014) – Largest city in the UK – Population density of 5,432/km^2 – Average age 34 years	– Transport – Metering – Data use – Monitoring / data analysis	– City open data portal – London municipality – Smart City project	– ISO, BSI*, IEU, ITU
Amsterdam	– Population 835k (2016) – Largest city in Netherlands – Population density of 4,994/km^2 – Average age 42 years	– Mobility – Open data – Infrastructure – Economy	– City open data portal – Amsterdam smart city portal	– ISO, IEC, ITU, IEEE

Legend

ISO: International organisation of standardisation
IEC: International Electrical Technical Commission
ITU: International Telecommunication Union
IEEE: Institute of Electrical and Electronics Engineers
CEN-CENELEC: European Committee
BSI: British Standards Institution

1.0: CATALYSTS FOR THE DATA ECOSYSTEM

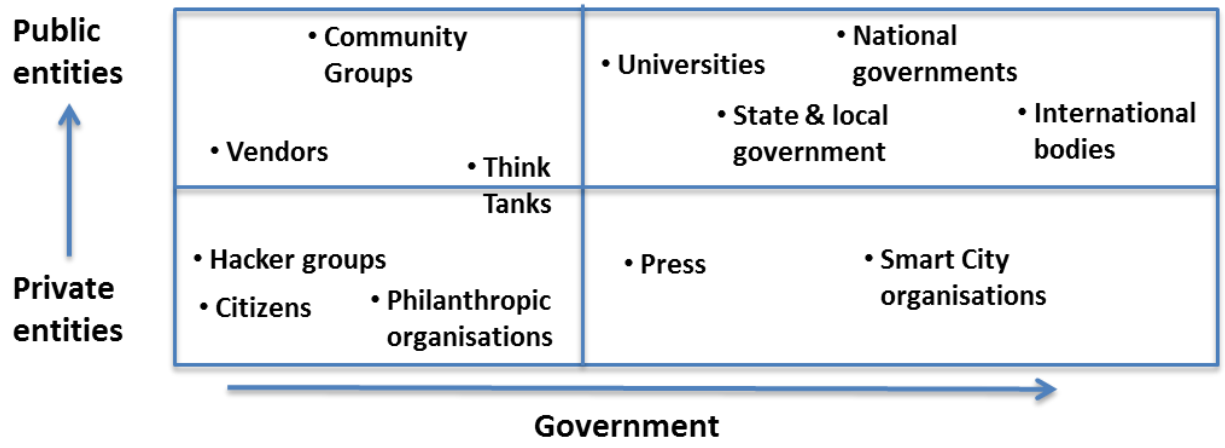
1.1: STAKEHOLDER PARTICIPANTS

Current stakeholders in Smart Cities would present their movement as one that emerged out of the increasing importance of ICT (Information and Communications Technology) in the mid-1990s. Yet its genesis actually goes back to at least 1968 when the Los Angeles Mayor, John Lindsay, established the Community Analysis Bureau and engaged the Rand Corporation "to streamline city management through computer models." [6]

From the early 2000s, the phrase "Smart City" has been marketed by global technology firms such as Cisco, IBM and Siemens. In fact, IBM has actually taken out a trademark on the phrase "Smarter City". [7] It's currency in the early 2000s was exclusively applied to entirely new cities being built or proposed by governments to showcase national aspirations. Songdo in South Korea, Masdar City in Abu Dhabi and Planet IT in Portugal (which has never eventuated) are examples of this. [8] The IT companies involved are marketed as shareholders in these projects but more often than not, have taken significant consulting fees from the governments promoting them as the end in itself.

If the stakeholders and their motivations were already opaque in treating with new city initiatives, this becomes a ten-fold challenge in applying Smart City applications to existing urban settings. Table 2, identifies the types of stakeholders that emerge in this more complex environment.

TABLE 2: Key stakeholders in the Smart City movement



Granted, this table is static but there are real nuances in this stakeholder profile borne of geography and governance "mechanics." More specifically, European and American stakeholders differ in several ways. The role of philanthropic organisations in funding Smart City initiatives is distinctly different. In the

[6] Lindsay. G "Not-So-Smart Cities" The New York Times, 24/09/11

[7] Sonderstorm. O "Smart Cities as Corporate Storytelling" City Vol 18. Issue 3, P 307.

[8] Ramachandran. B "Are Smart Cities becoming a reality with internet of everything" connectedtechnbiz.wordpress.com. October 8th 2014

United States they continue to be a key driver. Foundations such as Bloomberg Philanthropies, the MacArthur, Knight and Sunlight Foundations have provided funding to programs in Boston, New York and Chicago. The Brookings Institute and a number of Universities have also made contributions. Bloomberg Philanthropies, for example, recently awarded US$32M to Harvard University's Kennedy School to educate up to 300 city mayors in city "innovation".[9]

In Europe, the key stakeholders have been governments of different types. The most notable stakeholder has been the European Union (EU) itself. It has sponsored civic community groups, national governments and the press in promoting the value of the Smart City.

Global vendors such as Google (Sidewalk Labs), Cisco, GE, Siemens and IBM have focused initially on taking on advisory roles rather than equity positions in Smart City projects. This is now changing. Cisco for example has "elevated" cities like Adelaide and Barcelona to "Lighthouse City" status proposing to spend over US$20 Million on research centres in each city respectively. [10] Sidewalk Labs have made a significant investment in a Wi-Fi project with the City of New York. [11]

In those cases, the vendors also fostered strong relationships with other stakeholders. Both International standards bodies, like the ISO, and dedicated Smart City organisations, such as the Smart Cities Forum, have actively been pursued to partner, with the key intent being to have their city operating platforms adopted by other cities through these organisations. They also have out-reach strategies with community groups like Code America, UK and Australia through sponsorships. [12]

The fundamental question remains as to what extent these stakeholder groups are actually "organic" or manufactured? For there is an argument that a range of government and philanthropic organisations are advocating a "top-down" management directive for the development of Smart Cities. IBM for example allocates a significant part of its "Smarter City" budget to a range of other stakeholder groups.[13] Without genuine stakeholder engagement, the merits of the smart city could be contrived as disingenuous as the services being offered risk being irrelevant to the real citizens that are supposed to use them.

1.2: DATA ECOSYSTEM STRUCTURES

The data ecosystem structures evolved by governments in the five global cities under analysis largely fail to cater for the promise of Smart City interoperability. But this is not a failure of resourcing. There are a plethora of government entities and programs that address the collection and application of data. Yet the evolution of these constructs belies a siloed and vertical managerial approach to the delivery of Smart City services.

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[9] Herndon. A "Harvard, Bloomburg unite for $32m Initiative by Mayors" The Boston Globe 26/08/16

[10] Jacks. T "Cisco Invests $15m US in New Australian Innovation Hub" Australian Financial Review 18/03/15 Walt. V "Barcelona: The most wired city in the World Fortune 29/07/15

[11] Roberts. TT "Google's $800m on Sidewalk Internet is Still a Wild Card" Fortune 18/08/16

[12] Each website has partner support from vendors like Google and Amazon Web Services

[13] Warner. B "This Watson App is helping Athletes go for gold in Rio" Forbes 3/06/16

Table 3 indicates that all cities reviewed, except Barcelona, have extensive siloed data functions where connectivity within a certain service stream is cohesive but there is little horizontal integration. Barcelona stands out as the only city in the review that has taken a holistic strategic approach to its data ecosystem.

It's vertical, horizontal platforms, which pivots on three key axes, is giving the city a durable digital fabric which generates, according to the City of Barcelona, "profound efficiencies, transparency and social equity". [14]

Effectively, Barcelona is building its own distinctive data ecosystem. In contrast, Amsterdam's Economic Board has ruminated of its own digital agencies which have been established since 2007 - "No single organisation co-ordinates all their efforts".[15]

Perhaps the "answer" lies not in absolute structural co-ordination, but rather in the relevance these data services have to actual citizens. The "Top-Down Mayor's Office" approach to data services has had mixed results for cities - Amsterdam completely recasting their strategy and London rebuilding their digital structure. In this context, Barcelona's data ecosystem has substantive merit.

[14] Smartmatic Editiorial. "Barcelona wants to be a benchmark Smart City." 06/12/2013.

[15] Fitzgerald. M " Data Driven City management: A close look at Amsterdam's Smart City Initiative" Sloan Review. 19/05/2016.

TABLE 3: Evolution of data ecosystem hubs

Data hubs	Vertical ecosystem			Connected ecosystems (Horizontal and vertical clusters)	Virtuous growth
Barcelona – Mayor's office SC – Personal Management Office (PMO)(2011)				**Axis 1** International promotion ⇨ **Axis 2** International collaboration ⇨ **Axis 3** Local projects 13 key project areas 22@Barcelona (100+ projects)	None
	Data service examples				
New York – Mayors office (2010)	Office of Technology & Innovation (OTI) ⇩ Link NY	Office of Data Analytics (ODA) ⇩ Data liaison	Office of Recovery Resilience (ORR) ⇩ Manhattan Resilience Project		None
Boston – Mayor's office of new urban economics (2010)	Streetscapre ⇩ "Adopt a hydrant"	Education ⇩ "Classtalk"	Engagement ⇩ "Citizens connect"		None
London – Technology Strategy Board (TSB)(2004-14) – Innovate UK (2014+)	City Deals ⇩ Greater Manchester Project	Open Data ⇩ Transport for London Catapult	New Tech ⇩ Digital Greenwich		None
Amsterdam – Amsterdam Economic Board (original) (2007) – New Amsterdam Economic Board (2013+)	Amsterdam Smart City (ASC) ⇩ "Smart mobility"	AEB Amsterdam (AEB) ⇩ "Safety platform"	Amsterdam Advanced Metropolitan Solutions (AMS) ⇩ "DC Smart Grid"		None

2.0: GOVERNMENT REGULATORY RESPONSES

The regulatory response of the five cities under analysis to the exponential growth in data has been varied. It has also been multi-layered and at first glance is as confusing as defining the Smart City itself! Table 4 provides a summary of the parameters of the various governments' regulatory responses. There is one salient observation that reveals itself in this exercise. It is those cities that actually enact legislation around their data ecosystem and the panopoly of Smart City initiatives that are best placed to shape and control their urban digital future.

2.1: PRINCIPALS AND RULES APPLIED TO CITY DATA PLATFORMS

One could observe, reviewing Table 4, that on one level data regulations look very different between cities and yet on another level reflects "fractured" or "splintered" governance frameworks in action. The reality sits somewhere in between.

On a very broad level, the first point of distinction is the influence of EU oversight - compared to the American cities in this review which have no such framework. A more critical observation of Table 4 reveals that, of the three European cities, only Barcelona has a set of regulations that have been enshrined in law, whereas London and Amsterdam simply apply standards and codes (Although a Dutch Data Act was enacted in the middle of this year.) In the American context, New York has been the most active in passing data legislation. In fact, their Open Data Law (No 11) enacted in 2011, was updated in 2015, making it mandatory that all municipal departments post their data on their open portal by 2018.

All five cities license their open data free of charge, although it is interesting to note that the European cities actively utilise the Creative Commons copyright system (notably the CC-BY 3.0 license). This can bring its' own contradictions as well. For example, Barcelona adheres to the CC-BY 3.0 license which allows for the commercial re-use and altering of data published. But its' national act, Spanish Act 37, explicitly forbids it. The American cities have been slower to adopt this copyright standard (although it is US in origin). The City of London utilises its national government's Open Government License which is compatible with the Creative Commons attribution (CC-BY) license.

Through the myriad of codes, standards and protocols initiated by these cities, it is those that have passed data laws that give its citizens most certainty about their data rights. Codes and standards, elaborate as some may be, are vulnerable to the vicissitudes of government policy change. Making law is hard but the outcomes for citizens-enshrined rights actually makes data and its use more equitable compared to those citizens whose governments have not been able to achieve a legislative outcome.

2.2: GOVERNMENT BUDGETS

Given that the Smart City movement has partly been a policy response to the GFC, as much as the rise of data and its' applications, cities have largely not been in the position to fund significant and sustained "Smart City" budgets. Rather they have relied upon competitive grant processes established by national and international institutions to underpin their Smart City programs.

The European cities, inclusive of London, have drawn significant funding from the EU's Framework Program for Research and Innovation. London has also drawn funds from Innovation UK and its' predecessor - the Technology Standards Board (TSB). Funding for these cities has not been in isolation. Parallel funding to numerous secondary cities such as Cologne, Manchester and Vienna has been ongoing. All European cities are currently drawing specifically from the EU's 8th Framework Program called Horizon 2020. It has a budget of €79 Billion for allocation. While the remit of this program is very broad, key smart cities like Barcelona and Amsterdam are tendering for €131 Million in Smart City projects in 2016.[16]

As a counterpoint, the American cities in this study have funded Smart City programs out of recurrent municipal budgets (New York City's entire budget in 2015 was US$69 Billion). There is, however, no discernable breakdown of open data funding to data offices either in New York or Boston. The Obama Administration has recently provided some US$240 Million for Smart City Programs but much of this is allocated for "secondary" or "follower" cities.[17] In short, Boston and New York rely significantly on vendor partnership programs and philanthropic trusts to fund Smart City initiatives.

[16] Cheasty. T. Smart Cities & Communities (Horizon 2020 Budgets) 2015

[17] Morris. D "Smart Cities think big with $160m White House Program" Fortune. 16/09/2015. The White House (Office of the Press Secretary) "Announcing over $80m in new Federal Investment in…White House Smart Cities Initiative" 26/09/2016.

TABLE 4: Government Regulatory Responses: An overview

Smart city	Regulations and policy	Open data strategy	Licensing	Budgets
Barcelona	Regulations – EC Data Directive 98 (2003) – Spanish Act 37 (2007) – Open Data BCN Act (2016) Policy focus: Equitable access to data	– Data should be accessible – Create new services with social / commercial value – Improve competition in city services	– Free of charge – Open license – Creative commons – Attribution (CC-BY 3.0)	– EC Horizon 2020 budget tender – Barcelona City Council
New York	Regulations – NY Open Data Law N°11 (2012) – NY State Data Security Act (2015) – US Open Government Data Act (2016) Policy focus: Standards and procedures	Data transparency across: – Budgets – Healthcare – Environment	– Free of charge – Open license – CCA	– City of New York – Philanthropic Grants – Federal Government Grants Pool Allocation
Boston	Regulations – Open & Protected Data Policy (2014) – Mass Standards for the Protection of Personal Information of Residents (2010) Policy focus: Continuous data transparency	– Classifying public / private data – Issuing data in "public" formats	– Free of charge – Open license – City of Boston data license (2014) – Default (CC–4.0)	– City of Boston – Philanthropic grants – Federal Government Grants Pool Allocation
London	Regulations – Greater London Authority Open Data Charter (2015) Policy focus UK Open Data Whitepaper (2012)	– Data for London strategy – GLA Open Data for users / providers	– Free of charge – Open license (Public sector data only) – Compatible with CC-BY 3.0	– EC Horizon 2020 budget allocation [1] – Allocation from Innovation UK Fund
Amsterdam	Regulations – EC General Data Regime (GDPR) – Dutch Data Act (2016) Policy focus – Data privacy protection	– Internal Government data sharing – Open data protocols	– Free of charge – Open license – CC-BY 4.0	– EC Horizon 2020 budget tender – Amsterdam Economic Board

Note 1: Will be in doubt given Brexit repercussions

3.0: MANAGING THE OPEN DATA ECOSYSTEM

Governments of different kinds have responded to both the volume and value of data in varying ways. While the statistic that 90% of the world's data has only been generated in the last two years is a catchphrase of the IoT age, [18] it also begs the question of where this data is generated, how it is defined and, indeed, how it is aggregated. The importance of this point is highlighted by Intel's David Hoffman who observes "the most important moment of data is its' aggregation." [19] So, data "exhaust" is now a culmination of Government, sensory, social and private domains and can be classified as open, commercial and private.

Motivated by the realization that data is a key pillar of a country's infrastructure and that it has inherent commercial value, key national governments in Europe and Asia, in particular, have promoted their own data ecosystem platforms as the international standard. On one level, it is an attempt by federal governments to at once control their own data as well as have reach over data generated by private organisations and citizens themselves. The German government is actively promoting its' Industrie 4.0 platform, the United Kingdom government Hypercat and China's "made in China 2025 initiative" to their trading partners. [20] Australia has not been immune to their collective entreaties. In terms of data generated by governments themselves, many have established national open data portals over the last five years. Ironically, however, open data portal development has evolved with more sophistication and relevance at the level of the city.

A key point of reflection is that although the five cities reviewed have aggregated over 3,300 data sets for public use, which is impressive, open data by itself does not guarantee open government [21] and a city's promotion of it can sometimes obscure the need for other infrastructure. [22] Still, as Table 5 demonstrates, cities are increasingly recognizing the merit of open data portals as a key means of achieving citizen engagement.

3.1: OMNIBUS OR MULTIPLE PLATFORMS

All five cities reviewed have built significant open data portals. New York has published over 1,500+ data sets but it would be reasonable to observe all cities are growing their aggregate data catalogues by 10% year-on-year. Each city is also API (Application Program Interface) accessible, meaning that published data can be configured in such a way that external developers can reconstitute data into a form where they can build data products and on-sell to aligned stakeholders. While much has been made of API-enabled data products, those new data markets are still very immature. It's true that cities such as Barcelona host "Apps BCN" and a smart city "AppHACK". New York also has an annual "Big Apps"

[18] Savitz. E "Big Data: Getting Ready for the 2013 Big Bang" Forbes. 15/01/13

[19] David Hoffman- Record of the Communications and Society Program Aspen Institute. May 2016. P32

[20] Kennedy. S "Made in China 2025" CSIS. 1/6/15.

[21] Tisne. M "The Magic In The Room: How The Open Government Partnership can inspire and go to scale" Tisne.org(Blog) 16/4/16.

[22] Goh. B "Securing The Smart City" Harvard Kennedy School Journal 07/09/16

competition to promote developer marketplaces. Cities eagerly market examples of success.[23] London highlights that it's 5,000 developers have registered to use its' Tfl (Transport for London) data with successful Apps like Citimapper are the result. [23] Yet governments still see these initiatives as "add-ons" and not a part of their core service delivery. Furthermore, their terms of use make no promise of reliability, accuracy, or regularity of data supply - thus making the life of a developer an uncertain one.

3.2: OPEN OR CLOSED

Whilst the spectrum of government data includes much of what is legitimately closed and restricted, the original arguments for open data were framed under the values of open government, open-source and citizen-centric transparency.[24] But increasingly, software entrepreneurialism is transforming data from an innate state, then to "infrastructure**"** and now, ipso facto, to an "asset" with value.

It should come as no surprise then that the rhetoric of the new IoT platforms that seek to enable better models of governance are now perceived to threaten notions of citizen privacy, transparency and security. Capturing the seeming contradictions of human behavior in the design of open data platforms, is therefore fraught with challenge. Table 5 indicates that while some cities like Boston have data security and privacy policies for their portals, the majority remain directly silent on these; relying on what is afforded in "soft" law at an international level - although US legislation in this case has been active recently.

3.3: DATA INTERACTIVITY

The data sets published through the open portals of cities under review are increasingly interactive and available for citizens and governments alike. Cities and developer stakeholders access data sets that are either updated daily or streamed, just in time, through an API. New York updates 20% of its dataset catalogue on a daily basis, whereas the London City open portal has specific publishers like Tfl who stream a real-time traffic data set. City dataset interactivity is a key driver in building citizen and developer usage of, and confidence in, the open data portals.
In a broader context, nearly all of the city portals reviewed are partially "harvested" or "mined" by their national open data platforms. Yet there is not a mechanism or protocol as to how a city portal shares its data between different governments. For example, Barcelona has by-passed its national data portal in favour of providing data to the European Data Portal. Boston has most of its data harvested by its State portal, Massdata, not its federal portal. And yet again, UK data is harvested by the European Data Portal (although this may change post Brexit). There is also no seeming rationale as to what kind of data is harvested. It may have more to do with the technical requirements in acquiring data rather than the inherent value of the data itself. Homogenous specifications around metadata and standards, as well as what kind of API is used to retrieve data, are therefore critical.

[23] Shaw.R "Top five best transport apps" Which.co.uk. 08/07/15.

[24] Bauns. S "Mine you data: Open data, digital strategies and entrepreneurial governance by code" Journal of Urban Geography. Vol 37, 2016, Issue 4.

3.4: OPEN DATA PORTALS: OWNERSHIP, MANAGEMENT AND PARTNERSHIP

One could argue that the ultimate endpoint of technology disruption characterized by the internet and IoT is that it renders governments "impotent." Put less colourfully, the key question is who owns and controls the Smart City and the data it generates? Governments obviously see a role for themselves, vendors and citizens in this ecosystem. The vendors, however, do not. Their commercial experience and actions have created a "winner takes all network effect"[25] It is conceivable this market will be inevitably dominated by the global consumer services of an Amazon or a Google. There has, until very recently, been a litany of "bombastic and prolific" promotional materials, white papers and policy reports authored by vendors offering the "machismo" of transformative change. This discourse is now changing to give other stakeholders limited roles within vendor strategy plans, but their core psychology remains unchanged.

The "fault line" between government and vendor views in the delivery of open data services, is elegantly summarized by the type of portal platforms being utilised by the five cities under review. Table 5 depicts this. Both of the North American cities, New York and Boston, utilise, under license, a private and proprietary platform based out of the United States called Socrata. In contrast, the European cities use the open- sourced platform, CKAN.

The cities that utilise the Socrata platform argue that its 24/7 service features, general usability and it's as-a-service fee structure make it an attractive option to adopt. CKAN cities admit that the platform has higher capital and re-current cost structure than its counterpart but argue it provides better transparency and the best environment to support local start-ups, developers and service providers.[26] A further complication arises in terms of the interoperability between the platforms and their applications by different levels of government. For example, while New York utilises a Socrata platform the US government employs CKAN. (In Australia, the Federal Government and Victorian Government use a CKAN platform but the City of Melbourne uses Socrata.)

All city open data portals have partners. Most are semi- or quasi-government in nature, being either Universities, Libraries or related agencies. Of some interest is that Boston now includes the Knight Foundation as a key partner, and although not specifically a portal partner, Barcelona has recently agreed to a joint venture to develop and maintain the city's IoT platform.[27] As the cost to support relevant open data portals increase, these kinds of public / private partnerships will increase. The axiom of this decision is put best by Madrid's Mayor Manuela Carmena: "What are the social problems we the citizens want solved (from technology city) and who can we use to best achieve this?" [28]

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[25] Edwards. L "Privacy, Security and Data Protection in Smart Cities: A critical EU law Perspective" Creative Working Paper Dec 2015. P 7-8.

[26] Reddit (Blog) "CKAN-Advantages & Disadvantages"

[27] Ballard.B "Barcelona Partners with Cisco to pioneer IoT Smart City" Internetofbusiness.com. 22/01/16.

[28] Bilgvami. R "If Technology is the Answer, What is the Question?" Sustainability.com 17/03/16.

TABLE 5: Open Data Portal Ecosystem

Smart city	Portal profile	Portal policies		Virtual / static data	Portal data ownership	Portal data partnerships	Portal integrators
Barcelona	BCN open data portal – 330 data sets – API accessible	Cybersecurity Privacy policy FOI	No Yes No	– Popular datasets updated daily	CKAN	– City tenders data services – CISCO (IoT platform)	– No integration with National portal
New York	NYC open data – 1,500+ data sets – API accessible	Cybersecurity Privacy policy FOI	No No Yes	– 15-20% of dataset catalogue updated daily	Socrata	– NY University – Columbia University – Vizalytics	– Portal integration with National portal (data.gov)
Boston	City of Boston open portal – 130 data sets – API accessible	Cybersecurity Privacy policy FOI	Yes Yes No	– Semi-static datasets available on request	Socrata	– Knight Foundation – Boston Public Library – Department of Innovation & Technology	– Portal integration with State portal (mass.gov)
London	City open data portal – 683 data sets – API accessible	Cybersecurity Privacy policy FOI	No No No	– Datasets updated on published schedule – Tfl real time traffic streamed	CKAN	– Greater London Authority – EIT Digital	– Partial integration with national portal (data.gov.uk)
Amsterdam	The open data portal – 663 data sets – API accessible	Cybersecurity Privacy policy FOI	No No No	– Datasets updated on published schedule	CKAN	– Amsterdam Economic Board – University of Amsterdam – 2CoolMonkeys	– Partial integration with national portal (data.overheid)

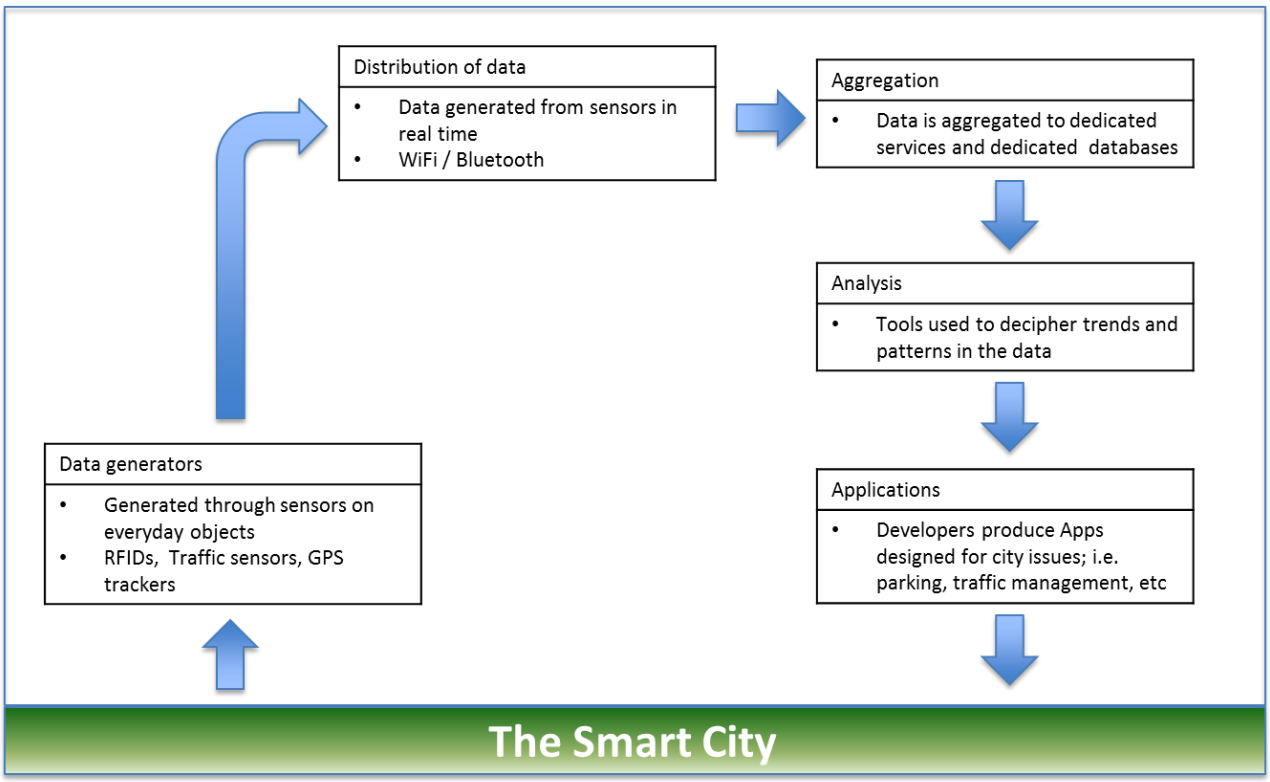
4.0: THE SOFTWARE AND TECHNOLOGY STACK

4.1: THE SOFTWARE

While the definition of the Smart City is skewed by stakeholder's self-interest, the cities in this review all share the same range of available technologies and software tools. But as has been observed of the Smart City data ecosystems: "it's just too large, complex and redundant; it's a confusing market and (Stakeholders) stumble when they are faced with too many decisions at too many levels of the technology stack. It has too many standards, it has too many engines, it has too many vendors." [29]

Achieving clarity in the midst of this software offering is challenging but can be clustered around five interrelated infrastructure elements:

TABLE 6: Smart City software clusters



A key observation is that all the cities under review are more likely to use software products which utilise local sources - both at a Data Generation and Application phase of the data ecosystem. At the points of Aggregation and Analysis the products of a Google, SAP, Microsoft or Amazon are more likely to be utilised.

[29] Brust. A "The big data ecosystem is too damn big" KDnuggets.com 06/16.

4.2: INTEROPERABILITY & EMERGING SOFTWARE

It should be re-iterated that interoperability across the two key open data portal platforms, CKAN and Socrata, with market software products is a positive maturation of the Smart City ecosystem. CKAN and Socrata are, for example, integrated with a content management system such as WordPress. Both can also integrate with emerging products such as DKAN.[30] New products such as Junar, a cloud based service, often with significantly improved visualization and analysis capability, can also be used by both platforms.

More broadly, the myriad of software products and services that can be utilised in the Smart City data ecosystem is overwhelming. [31]

5.0: SMART CITY "DIVIDEND"

The Smart City's movement clarion call as to its benefits, is not heard equally by all those stakeholders it seeks to reach. This misalignment is a corollary to the lack of clarity in the broader narrative. Given that specificity is the core value of its key technology and engineering promoters, the irony is obvious. This is not to dismiss its' core tenet, that technology can improve the functioning of a citizen's urban experience, but to argue its application as the decisive factor in the city's evolution is at best premature. The sheer scale, complexity, and indeed unruliness of the city is largely beyond the utility of any technology framework. Yet some benefits do exist.

5.1 THE SMART CITY - DRIVING COMPETITIVE ADVANTAGE

The notion of being "Smart" as a key pre-requisite for a city's competitive advantage over "rival" cities is a key theme of the literature. A range of annual awards provide plaudits to cities for their endeavors to be smart. Barcelona is the current titleholder of the world's smartest city and to underscore its pre-eminence, has recently hosted the Smart City World Expo. But the commentary is vague as to how Barcelona is turning its' plaudits into competitive advantage. There is much rhetoric about how its' "connectivity" is bringing financial and human capital to the city and generating export sales. However, this is mainly within the ecosystem of the Smart City industry itself.

While it would be dismissive to portray Smart City projects as tantamount to "platforms for parking apps," [32] the movement must move beyond the imagery of Richard Florida's "creative class" [33] and the rhetoric of Cisco (who actually publish material with the title "Is your City Smart Enough?" [34] and

[30] Blog "Data Repository Services" how-to.usopendata.org

[31] Tuck. M "Big Data Landscaper 2016" V18-Final mattuck.com 28/03/16.

[32] Nicholas. J "A Roadmap for Australian Smart Cities" GE Reports 28/07/16.

[33] Copeland R "Is "creative class" The key to reviving cities?" witf.com 5/10/16.

[34] Cisco Whitepaper. Is your City Smart Enough" Cisco.com 03/2011

develop programs that countenance the ambitions and wants of its' own citizens. Barcelona's 22@Barcelona is a program that most closely is attempting to achieve this.[35]

5.2 COMMUNITY PARTICIPATION

The Smart City movement, given its ICT-centric profile, has tended to adopt a top-down development style reinforced by a language and organizational structure that has not been inclusive for everyday citizens. This has given rise to criticism that it leaves no room for the technically illiterate… those who are marginalized and that the danger of a "data underclass", unable to access those rich new information sources, is very real.[36] While all of the cities in this review epitomize the rhetoric of genuine community access and interaction, there is little substantive evidence where this is the case. Moreover, where such initiatives do exist, some discernment needs to be made between those that are informed by a genuine grassroots motivation or confected by large corporates.

The pattern of organic Smart City community participation is most closely reached at the group level. Organisations such as Code for America (and its sister organisations in Australia, Canada, Europe and New Zealand) are actively structuring community access projects. Ironically, they are often supported directly by large corporates and governments they profess to mitigate against. (Code for Australia is supported by Google and indeed DELWP itself!) More informal groups have evolved around Community Mesh Networks, which are based around Wi-Fi communication used in local geographies. Mesh groups are active in New York (NY Mesh), Boston (Open Mesh), Barcelona (GUIFI), London (Consume) and Amsterdam (Leiden Mesh). The Things Network, an IoT community-based platform, is also present in all the cities under review. While the collective intention of these groups is to socialize access to the amorphous Smart City superstructure, they remain self-proclaimed stewards acting on behalf of a general citizenry largely oblivious to their activities.

Vendor groups are also endeavoring to encourage citizens to participate in the benefits of the Smart City in other ways. IBM have developed a program that reaches into real communities while dove-tailing into their longitudinal profit strategies. IBM's P-TECH schools programs are a case in point. It operates school programs, and or schools in all review cities (except Barcelona). These P-TECH schools form part of IBM's Corporate Services Division and are a key driver in it's "Smarter Cities Strategy." [37] Similarly, Samsung, SK Telecom and Cisco's investment in an entire smart city at Songdo, South Korea, represents at a scale, an ambition to recast the entire community in their image! Perhaps what these corporate approaches lack is, on one level, a core relevance to individual citizens and, on another, no genuine agency where people feel empowered to contribute to any programs promoted.

[35] Wire 2015 Paper. "Local innovation ecosystems & specialisation: the 22@Barcelona case" wire2015.eu 5/06/15

[36] Vanolo. A "Smartmentality: The Smart City as disciplinary Strategy" Urban Studies. Vol 51. No 5 April 2014 P892-894.

[37] Cobbold. T "P-Tech schools are Unproven and Threated Public Education" Education Policy Brief- Save our Schools, May 2015.

5.3: MONETISING OPTIONS

”Monetising” is a term whose currency has enjoyed a meteoric rise in the social media / digital economy. Yet it needs to be emphasized that it should not automatically be construed to equate to the known financial metric ROI (Return on Investment). The Smart City is still a nascent state. The connectivity benefits it is meant to achieve are currently only around potential municipal cost savings. Also the quantum of proposed savings is not reaching some earlier bold predictions. In 2012 Cisco claimed cities “will achieve a 50% reduction over a decade in energy consumption, a 20% decrease in traffic, an 80% improvement in water usage and a 20% reduction in crime rates”.[38] Obviously, despite this kind of optimism, none of the cities reviewed can make this claim. While some media**,** sympathetic to the vendor position, claim that efficiency has been hamstrung by the silo practices of municipal councils. Of course, the commercial “DNA” of the Smart City or the “New Oil” [39], as others have mused, is data! Its’ new financial value is not indexed to analogue pricing models which historically have been advertising based, license or pay-per-use. It is now centered on leveraging IoT platforms producing value-added data services which can be sold or licensed to stakeholders. More precisely, public data-subscription feeds that combine multiple sources of data, data analytics and machine learning will become the norm. Copenhagen is the first major city to move in this direction, partnering with Hitachi. It is establishing a data exchange to market its’ own and private data, notably in traffic management, energy usage, home break-ins and weather. While the Copenhagen initiative deserves much closer examination (it only launched in May 2016), it would seem there is no immediate legal framework in which it exists. As emphasized in Section 3.4, without a strong interventionist statutory framework, the commercial value of this data could be jeopardized.

6.0: CONCLUDING REMARKS

There are still parts of the Smart City discourse that have parallels to L. Frank Baum’s “Emerald City” in the film Wizard of Oz. Here the wizard who controls the city is a fraud who uses theatrical technology to exert and maintain power. Some critics of the Smart City go further, framing it as a panoptic vision of the future where citizens are reduced to “smooth moving pixels”. [40] Despite these laments there is a growing maturity in the Smart City movement. Stakeholders are beginning to realise that it’s not a zero-sum game narrative that pitches infrastructure against people, top-down against bottom-up, technology against urban design or proprietorial versus open source. The Smart City is about genuine citizen engagement. This means that citizens must be educated about the value of the data they personally generate and that the genuine citizen participatory pathways are legislatively “baked on” to the data platforms being constructed by both governments and private groups alike. These lessons are to be overlooked at a Smart City’s peril, for telling citizens to “eat (data) cake” has not historically ended well!

[38] Elfrink. W “The Smart City Solution” mickinsey.com. October 2012.

[39] Vanian. J “Why Data is The New Oil” Fortune 14/07/2016.

[40] Poole. S “The Truth about Smart Cities: “In the end they will destroy democracy” The Guardian, 17/12/14

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