016

Urban development

Jean-Noé Landry

Key points

- Open data in the context of urban development is increasingly linked with "smart cities" and "urban resilience" agendas.
- There has been a shift from an early emphasis on hackathons, seen as a potential mechanism for co-production of public services with external experts, toward working on data standards, infrastructure, and in-house analytical capacity within city governments.
- Intermediaries, including public-funded organisations such as libraries, have an important role to play helping citizens gain value from urban open data.
- Without further work crafting practitioner communities and clear agendas, open data is likely to be seen primarily as a tool to be selectively used in smart cities, rather than as the central element of a comprehensive approach to achieve more open urban development.

Introduction

Since 2008, more than 50% of the world's population has resided in cities.[1] Estimates suggest this figure will be over 66% by 2050,[2] with much of this urbanisation taking place in the developing world. The ongoing growth of the urban environment and of urban density brings with it both opportunities and challenges. Creating vibrant communities, maintaining mobility, delivering essential services, and creating low-carbon development depend on a mix of planned and emergent action, all of which has come to rely more and more upon data. However, there are differing visions of effective urban development from centralised and highly technical "smart city" narratives that envisage a city organised using predominantly proprietary and commercial technology[3] to "smart citizen" viewpoints that stem more from an ad hoc bottom-up model of urban development based on open technology and open data.[4] The reality for many cities will likely lie somewhere between these extremes, and, over the last decade, open data has played a

critical role in creating the space for dialogue about the future of the city and in providing a platform for various urban innovations.

To some extent, the template for the wider open data movement was originally set at the city level. In 2007, Vivek Kundra (who later became chief information officer for the United States (US) government and the architect of data.gov) launched the Washington, DC data portal, opening up datasets that had previously driven the government's own CitiStat dashboard.[5] Recognising the limited capacity of the city bureaucracy to develop new solutions with its own data, the driving goal was to harness ideas and energy from outside government. Today, hundreds of cities have their own open data portals (although this appears to be much more common in North America and Europe than in other parts of the world),[6] and many have hosted events to spur on use of this data to support engagement with independent developers, researchers, and municipal open data champions.

More recently, as the Sustainable Development Goals (SDGs) and the debate around resilience have become key elements of the mainstream development agenda, questions on how open data can play a role in urban sustainability and urban resilience have received increasing attention.[7] In many cities, a lack of data can hamper efforts to plan and coordinate development or lead to certain populations ending up "invisible" with their needs neglected as city leaders push forward with major infrastructure and construction projects. On the other hand, the innovative use of open data has provided the means for citizens to get involved in local government, using statistics, data visualisation, and storytelling to engage in debates about shared urban futures.

In this chapter, we explore these themes through four lenses: innovation, infrastructure, measurement and management, and resilience. We also identify some of the principles, interventions, and attitudes that will be required for open data-enabled urban development in the years ahead.

Innovation: From experimentation to institutionalisation

The concept of innovation is often a contested one because of the ambiguity around determining what is, or is not, innovative. However, since the earliest open data app competitions, the idea that releasing open data can unlock innovative capacity for urban development and local economic growth has been compelling for community-minded developers and service providers.[8] Open data has been framed as a tool to engage a wider range of actors in solving municipal problems, harnessing "innovative ideas" from academics, citizens, and the private sector. Sandoval-Almazan et al. describe this as creating new forms of citizen empowerment,[9] and Hielkema and Hongisto have argued that app competitions based on open data are important venues to bring together stakeholders (including government, developers, and users) to initiate collaborative projects and enable the private sector to tailor products to the public.[10]

Hundreds of urban open data hackathon events have taken place over the last decade, providing new points of connection between city officials and technically skilled communities who want to engage with them. When organised by government, they demonstrate a clear recognition of the fact that open data initiatives require more than just data release.[11] The hackathon model has been used across the world and, in many cases, framed as a catalyst for urban and economic development.[12] Building on a "government as a platform" premise, many

early hackathons were based on the belief that innovation could only come from outside government. Over time, there has been a shift to recognise that effective co-production through hackathons requires a more strategic approach, with officials taking a more active role in defining problems and in finding, preparing, and using relevant datasets.[13]

Although popular, hackathons have also been subject to critique. Researchers have questioned their ability to produce meaningful social impact and citizen engagement, noting that there is scarce evidence of the link between hackathons and economic growth.[14] Johnson and Robinson have further argued that open data, particularly when delivered as part of a hackathon-model, may promote a particular model for outsourcing government functions with potentially negative outcomes for urban development.[15] City governments have also struggled with how to partner with, or procure from, civic entrepreneurs who will work with their open datasets. This has led to many hackathons focusing more on acting solely as demonstrators of what could be possible, rather than on the development of active tools to transform urban governance or city living. A number of studies have looked at identifying how cities can better design innovative competitions and events and how best to secure lasting impact from them.[16,17]

Linking open data and urban governance in Jakarta

In 2014, the Southeast Asia Technology and Transparency Initiative, the Web Foundation, and Government of Jakarta worked with a range of partners to host "HackJak", a two-day hackathon, where more than 100 participants worked on 53 different projects. Organisers took advantage of Indonesia's upcoming role as government co-chair of the Open Government Partnership to secure interest and participation in the event, which resulted in several prototypes, including an application that provided live feedback on public transport shelters and tools for navigating and engaging with the city budget.[18,19]

In 2016, Jakarta's Provincial Disaster Management Agency, the National Indonesian Disaster Agency, the World Bank, Humanitarian OpenStreetMap Team (HOT), and other partners convened another hackathon to explore how technology, data, and open collaboration could be marshalled to address challenges around flooding. Five teams developed prototypes, including designs for tools that would keep citizens informed during flooding and provided an analysis on the areas of the city most vulnerable to flooding.[20]

Over time, city engagement with open data has become professionalised. Numerous cities now have internal innovation labs, connecting work on open data with wider themes of data-science, service design, and technology innovation. One of the early examples, Boston's Office of New Urban Mechanics, operates as a cross-departmental unit focused on addressing specific city challenges.[21] In the City of Buenos Aires, open data, open government, and smart city activities have been placed under the same directorate, the Innovation and Smart City Undersecretariat (Subsecretaría de Innovación y Ciudad Inteligente).[22] This integration of "openness" (open data and open government) into urban development, or "smart city" work, is becoming more common. In Montreal, the recently established Urban Innovation Lab[23] has absorbed all staff previously working on open data, mirroring a pattern seen in a number of

cities, where external civic hackers and entrepreneurs were hired by government and then given a wider set of responsibilities that incorporate, but do not entirely centre around, open data.

This blending of open data into broader technology-driven urban development agendas has both benefits and risks. With the application of consistent values and principles, it can help drive an "open by default" approach to work on innovation and co-production. However, it can also lead to the importance of openness being downplayed or to less engagement with the kinds of experimental citizen engagement spaces that characterised early work on open data. A focus on instrumental and institutionalised use of open data may also orient work solely toward service delivery and away from transparency and accountability as is suggested in the framing of the 2013 Code for America book *Beyond transparency: Open data and the future of civic innovation.*[24]

While many new ideas and approaches have emerged from urban planners and service providers engaging with open data, in many cases, cities are facing similar challenges and, therefore, looking at similar solutions. For example, public transit apps, 311-reporting systems, city dashboards, and resource directories, although once innovative, have become open data initiatives more commonly adopted by cities whenever the data infrastructure exists to drive them. However, when it comes to the availability of data infrastructure, the picture is much more mixed across the globe.

Data infrastructure: Ownership and interoperability

Centrally coordinated management of the physical infrastructure of a city (electricity grids, water supply and waste disposal, transport networks, city services, etc.) requires a substantial data infrastructure. This data infrastructure relies, in turn, on a telecommunications infrastructure to connect sensors, staff, and systems together.[25] In the context of "smart cities", this infrastructure is usually built by private firms and offered as a package that may give corporate platform providers considerable control of the hardware, software, and data involved in city operations, and which may bring long-term dependency on specific vendors. Alternatively, some cities are piecing together legacy systems, or working with a mixed ecology of public, private, and citizen-generated data, laying the foundations for a more open model of the "smart city". Regardless, central to interoperability of these systems will be the continued development of open standards.

Over the last decade, open data standards development has been an area of considerable focus. Standards and API (application program interface) specifications, such as Open311 (initially developed as an API on top of Washington, DC's existing "311" public request system),[26] have helped facilitate the creation of open data via crowdsourcing and opening up existing issue-reporting systems.[27] Services built on top of Open311, such as SeeClickFix[28] and FixMyStreet,[29] have provided new avenues for citizen participation and co-production, as well as demonstrating a range of business models for civic technology. However, although its potential and impacts have been widely discussed, Open311's own dashboard suggests full adoption has been limited, with just 25 city deployments identified at the time of writing.[30] There is also evidence that individual implementations of 311 have undergone semantic and ontological divergence.[31] Similarly, the roughly 60 city-relevant standards listed by GovEx and GeoThink in their datastandards.directory[32] project have only been adopted by a minority of cities.

Case study: Open311

In 1996, the City of Baltimore launched a simple non-emergency phone number, 311, to relieve pressure on the emergency 911 service. By 2001, a number of US cities had taken up the idea, providing access to a wide range of services via 311 call centres. Subsequently, the first experiments with web-based 311 contacts started in Chicago. In 2008, SeeClickFix, a product that enables US cities to accept 311-style reports, was launched by a for-profit firm[33] in parallel with a similar platform, FixMyStreet, that was launched in the United Kingdom by MySociety.[34] The growth of 311, and of digital 311 platforms, meant increasing amounts of data on issues facing cities but also led to increased risks that different cities would be collecting fragmented data that was locked into proprietary systems.

In 2009, the Open311 project was launched to develop an open API specification that would support both data collection and retrieval on reported issues,[35] turning 311 services from a one-way communication to government into a conversation between government and citizens about pressing issues at the neighbourhood level. Open311 specifications, created through an open community process, have now been implemented for both FixMyStreet and SeeClickFix, as well as custom systems in a number of municipalities. The presence of a standard has also given new cities a head-start in developing their own systems.

One urban data standard that has achieved widespread adoption is the General Transit Feed Specification (GTFS) for public transport schedules, which originated as a project between Google and the City of Portland.[36] While implementations of data standards in developed countries are often intended to digitise and extend existing analogue services provided by government, implementations in the Global South may focus on the development of new services not originally provided by government. One such example, Digital Matatus, a university collaboration in Nairobi, has mapped Nairobi's matatus (minibus) transit routes, which dominate the public transit environment, using a citizen science approach and GTFS to improve local trip planning.[37]

The ultimate impact of open data infrastructures on urban planning is often indirect. For example, third-party transit apps based on GTFS data can improve the ability of residents, including those with disabilities and the elderly, to navigate urban environments, [38] while the data on how and when people are travelling can be used for research and urban mobility planning by local government.[39]

Whether the pace of development and adoption of open data standards is enough to ensure urban environments run on open infrastructures is a critical question requiring further research. Similarly, further work is required to track how far standards have progressed in making data shareable between cities as evidence to date suggests that data interoperability across cities and regions remains a major challenge. A lack of open and interoperability infrastructures will impact governments' ability to undertake collaborative urban development initiatives at a broader scale. However, within individual cities, governments are certainly looking at how they can make more use of their existing data through new models of data presentation.

Measurement and management: Seeing the city

Over the last decade, many cities have opened up hundreds of datasets that provide both a real-time and an historic view on the urban environment, and numerous projects have taken place to create urban dashboards driven by that data. The underlying idea that open data can be analysed and visualised in a simple interface (e.g. dashboard) is a key driver for municipal government,[40] linking open data with other fields connected to e-government,[41] urban data analytics, big data, and government data infrastructures,[42] all of which have explored mechanisms to combine and display multiple streams of data. One iconic example is the Rio de Janeiro Operations Centre,[43] which combines multiple streams of data, including open data, for predictive modelling of development and disaster scenarios. Such systems may not necessarily require data to be open in order to function, and the concept of a government operations centre has been around for a while,[44] but the addition of open data brings greater transparency to the calculation and presentation of city performance measures.

Open data-powered dashboards have become key public-facing instruments to demonstrate city performance on select indicators[45] and have often been deployed to support citizen engagement. Many examples, such as the City of Edmonton's Citizen Dashboard,[46] reflect a new approach to city performance measurement over the past few years, transforming data into information through simple charts and web maps. It is a model adopted both by cities and by cross-city collaborations. For example, in a project framed specifically around open data, the InterAmerican Development Bank has supported the creation of an Urban Dashboard platform for 50 cities in Latin America, providing access to benchmark indicators and survey data for individual cities and allowing for performance comparisons between cities.[47]

While performance dashboards can still be manipulated by governments to present higher levels of performance (including performance on transparency indicators) than the reality,[48] open data approaches add an extra level of traceability and accountability by publicly linking data visualisations back to source data and the data owner responsible. Engaging effectively with open data can require high levels of data literacy. This has led to the rise of infomediaries who can help citizens to engage with flows of data.[49,50,51] However, dashboards and performance metrics can only visualise data if it is available and, in many cases, relevant datasets are not available[52] or simply do not exist. If available, it is also critical to ensure they do not contain biased information about the urban environment that can contribute to the marginalisation of certain populations.

A recognition of the importance of shaping not only decisions made with data, but also the stock of urban data that supports decisions, has driven the work of groups, such as Transparent Chennai in India, who have deployed small teams of researchers to work with grassroots communities to generate new datasets on issues ranging from public toilets to road safety. By using their own dashboards, Transparent Chennai is able to present a different view on the city and to support citizens in making a case for change to government officials. The initiative seeks to establish a bottom-up model of the "transparent city" and enable "smart citizens" to overcome top-down models of traditional citizenship.[53] Similar models of bottom-up data creation can be seen in action, working on open data for urban resilience.

Resilience: Embracing citizen-generated urban data

The Rockefeller Foundation describes resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience".[54] The Rockefeller Foundation's 100 Resilient Cities (100RC) initiative has helped to establish urban resilience as a major topic in mainstream discourse. Resilience has often been framed as a problem of infrastructure,[55,56] while open data has usually been linked to the urban context as an issue for data infrastructure.[57] As a result, open data is now viewed as a key element of city infrastructure that can help to predict and ameliorate stresses and shocks.[58] This is increasingly important in the developing world, where open data[59] and open source software[60] are presented as tools for international development.

The Open Data for Resilience Initiative (OpenDRI) under the World Bank Group's Global Facility for Disaster Reduction and Recovery (GFDRR) was created specifically to incorporate open data into urban resilience projects through data collection, data portals, and data analytics.[61] With a focus on risk data, OpenDRI incorporates key open data principles, such as open by default, and has supported numerous urban (and rural) community mapping initiatives in the developing world. The programme has developed a field guide[62] and a guide to creating OpenDRI Open Cities Projects.[63]

Urban resilience has become closely tied to crowdsourced mapping efforts in countries of the Global South as it can help governments fill in the gaps in their spatial data collection, especially in the mapping of urban infrastructure.[64] OpenStreetMap (OSM) has become a dominant platform for crowdsourcing geospatial open data and has been adopted by many programmes, including OpenDRI. This work originated from crisis responses to large natural disasters, such as the Haiti earthquake of 2010[65] and the Nepal earthquake of 2015.[66] The Humanitarian OpenStreetMap Team (HOT), an entirely volunteer-driven community focused on disaster mapping around the world, was established in the immediate aftermath of the Haiti earthquake.[67] Mapping of urban environments in cities struck by disaster has allowed humanitarian workers to target their services more accurately. However, OSM as a crowdsourcing platform was recognised to have greater benefits beyond short-term mapping needs. Humanitarian organisations, such as the Red Cross, have recognised the potential of OSM to support development activities, map infrastructure, and form the backbone of government geospatial data infrastructure traditionally provided by the private sector. This is reflected in financial and data contributions from the Red Cross[68] and the Red Cross Missing Maps initiative.[69] OpenDRI has actively pursued the use of OSM for its own projects. Other organisations have used OSM for their own initiatives. For example, the Kathmandu Living Lab has been able to map large sections of Kathmandu and Nepal, leading to support activities, such as mapping literacy workshops to sustain local OSM mapping and data currency. HOT has since partnered with the Red Cross, the World Bank, and the US State Department, providing one indicator that the international development community has begun to embrace open data production as a core element of their activities.

Just as the release of government data created a space for citizens to explore new models of engagement with city governance, the rise of citizen-led data generation to support urban resilience has opened up new possibilities for co-production. Sustaining the participatory dimensions of these efforts over the longer term will be an important challenge to meet.

Taking stock and looking forward

In some ways, open data is a golden thread running through modern urban development work. Development needs data, and the open sharing of that data is clearly an effective strategy to support collaboration between different stakeholders. But, in many ways, open data is still peripheral to other, more integrated, data-related work within the urban environment. Mainstream urban development literature is more likely to talk about big data, sensor networks, and APIs than it is to talk about "open" data. There are established networks working on open "smart" cities, international collaboration on standards, and strong indications of support from major institutions, yet, even though urban open data initiatives have been successful in pioneering new models of collaboration and co-production, excitement for citizen–government collaboration based on a foundation of open data has often waned, and it is not clear how many cities have truly embedded a culture of openness through data into their organisational DNA.

To keep openness on the urban development agenda, it will be vital to maintain and visibly demonstrate the value of open data as other emerging technologies, particularly big data and artificial intelligence, start to take over the spotlight. Building on existing events, such as the bi-annual Open Cities Summit, will help, but much wider outreach will be necessary. There are also challenges ahead for both research and practice. Much more sustainable investment is needed in shared and scalable open data infrastructures if the potential of an open marketplace for urban development solutions is to be realised. The strong and consistent adoption of existing and new data standards will be paramount to increasing interoperability and reuse. In parallel, work is needed at the grassroots to promote a vision of open data as a powerful tool for urban development and co-production with opportunities for development that can be initiated by both government and citizens. This requires building connections between existing civil society groups working to support urban communities and the technical intermediaries who can help them to make the most of open data. Crafting these practitioner communities around open data will be an ongoing challenge, but, if successful, it will result in the knowledge sharing and effective data-driven problem-solving needed to address the challenges of modern urban development.

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About the author

Jean-Noé Landry is a social entrepreneur and Executive Director of OpenNorth, Canada's leading not-for-profit organisation specialising in open data, civic technology, and smart cities. As an open data expert, he convenes data stakeholders, promotes data standardisation, and connects governments to their data constituents. You can follow Jean-Noé at https://www.twitter.com/jeannoelandry and learn more about Open North at https://www.opennorth.ca.

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