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Urban data for improved everyday life

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When it comes to the quality of public spaces and the built environment, we immediately think about design principles, master planning, urban form and the shape of buildings and urban spaces. In the past, little thought has been given to the potential of digital technologies to help design high-quality urban environments.

Introducing data to urban development

Since the 1980s regional and local policymakers throughout Europe have been propagating different approaches to developing cities that are liveable, economically successful and increasingly sustainable. Throughout this quest for “the city of the future” urban developers and policymakers have seen various paradigms come and go. In the 1990s it was the bottom-up movements of the Local Agenda 21 that tried to push for a more inclusive and sustainable development of cities. Many city authorities incorporated their ideas and shifted the focus to climate change mitigation and sustainable development goals over the years 2000-10. Integrated urban development plans based on the Leipzig Charter and a large set of city-oriented action networks addressing all sorts of urban challenges were the results of this development. Polis, Eurocities, Energy cities or the URBACT city networks are strong and successful examples of this city-induced push for a more sustainable way of developing cities through integrated policies and sustainable action plans in Europe.

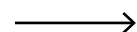
Around the year 2010, however, an important paradigm shift started to take place in the mindset of city managers, policymakers and industry leaders. With the digital revolution the urban potential of connected technologies started to shift into focus. All of a sudden, data and connectivity made it possible to maximise efficiency of urban systems by linking clean technologies, infrastructures, city operators and citizens through smart devices and intelligent services. Businesses – in consequence – identified cities and urban environments as new markets and started to introduce apparently tailor-made solutions for the connected and digital city. Today data-driven processes are improving our urban mobility systems and increasingly decentralised energy flows. They help city authorities to take better decisions, save money and to connect to their communities on a real-time basis. Taken together, this shift of paradigm is what is often talked about as the “smart city”.

It is evident that clean technologies and connected solutions offer significant opportunities to create sustainable urban environments, which support efficient municipal services whilst improving the quality of life for citizens in our cities. The following three examples stand for this potential in an exemplary way:

- **Digital technologies help us increase the efficiency of our cities:** we no longer need to possess assets like cars, bikes or even screwdrivers or workplaces. We can easily share them since we have the technology at hand to book, unlock, use and give them back according to our individual needs. A study by the MIT senseable city lab found that 95% of all taxi rides in Manhattan can be shared and the cumulative trip lengths be reduced by 40% if people are willing to walk only 200m¹. A recent Fraunhofer study has shown that 75% of all inner-city logistic trips can be consolidated and shifted to cargo-bikes.² Up to 93% of all parking spaces in cities will become obsolete if we shift to a shared, (electric) and

1 Santi, Paolo et al. (2014)

2 Fraunhofer IAO (2018) – Kurzstudie Innenstadtlogistik



autonomous mobility system.³ Using integrated services instead of owning fixed assets enables us to make much better use of the scarcest resource in our cities – the urban space.

- **Digital technologies help us achieve climate goals:** we know that most of the global carbon emissions stem from cities and urban operations, which is the reason why we must achieve the transition to low-carbon societies within our cities. Shifting from fossil fuel-based energies to renewable electricity, heating and cooling is a key pillar of this transition; but to make it happen, we need to link fluctuating energy demand (by offices, houses, vehicles and industry) to an unstable energy supply from wind, sun, biomass and geo-thermal energy. Data-driven solutions like virtual power plants or smart energy grids enable us to connect all types of energy sources with flexible energy demand by integrating storage systems (e.g. second-life EV batteries), charging stations for electric vehicles or even using the buildings and devices as a flexible energy storage unit.⁴
- **Digital technologies help us increase liveability:** beyond the obvious functionalities of digital technologies in cities, we as citizens have changed the way we communicate and find our way around in cities – and there are many applications that help city managers improve the way the city is operated. Smart waste bins know when they need to be emptied and help the municipal waste collection to be more efficient. Streetlights know when they can dim their light or shine in bright colours in order to increase a feeling of safety. Sound sensors help us predict anti-social behaviour. Air quality sensors help us regulate traffic flows and can be connected to congestion charging systems introducing dynamic prices for entering the inner-city area, etc.

The digital applications in cities are numerous. Initiatives like the European Innovation Partnership on Smart Cities and Communities,⁵ the Smart Cities and Communities Lighthouse Projects (SCC01) or the Fraunhofer Morgenstadt Initiative⁶ have been trialling and demonstrating the potential of digital innovations for an improved and more sustainable everyday life in our cities. Figure 1 shows an array of readily available data-driven urban solutions which, taken together, bear the potential of reducing up to 80% of urban emissions,⁷ significantly improving urban air quality and drastically reducing the use of public space for private cars.

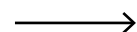
3 Braun, Steffen et al (2019)

4 A good example for integrated connected energy solutions is given by the EU H2020 lighthouse project SPARCS: <https://www.sparcs.info/>

5 <https://eu-smartcities.eu/>

6 www.morgenstadt.de/en

7 GeSi (2016)



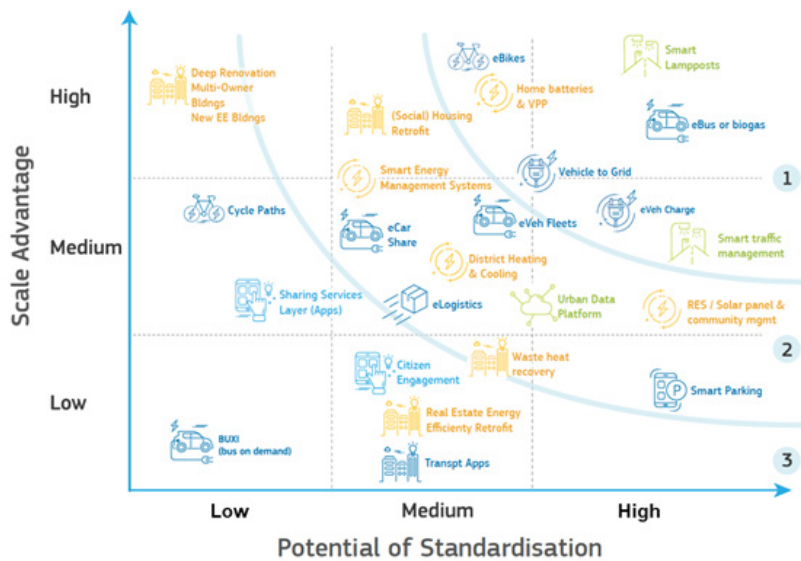


Figure 1: Data-driven solutions for an improved urban life⁸

The special characteristics of digital urban solutions

While most researchers and practitioners focus their efforts on the functional side and on the technological integration of data-driven solutions, little emphasis has been put on governance structures, processes, business model innovation and integrated action planning. We are missing citizen-centred design principles for digital urban solutions or – even more important – failing to ask questions of ownership, risks and profits associated with an increased use of data in our cities. For all the great potential that digital solutions bear for our cities, we must not forget that they are invented, deployed and operated by humans – and thus are biased as humans are, and often reflect the purpose and biases of the organisations that stand behind the person who writes the source code.

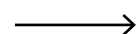
It is therefore a key challenge for cities and city planners to come to grips with data-driven solutions in a way that truly benefits the city, its citizens and the environment in a holistic and integrated way. Yet we seem to be unable to intuitively react to data-driven urban solutions with an adequate governance model. The reason for this lies in the fundamentally different nature of data, which requires urban developers and city managers to rethink the traditional cause-and-effect principles of urban design. Data represents a non-physical asset with distinct characteristics but by its use has a tremendous effect on the way our cities operate – and thus manifests itself physically.

Two characteristics make digital services stand out:

1. **Data has no marginal costs**,⁹ therefore a digital service can be offered to an arbitrary number of people irrespective of the resources that stand behind the service. In this sense it is misleading to speak of data as “the new oil” since its price is not determined via scarcity or physical availability and – other than with physical assets – the inexistence of marginal costs makes it difficult for us to understand, calculate or grasp the real value of data – at least with our traditional economic models.
2. **Data is ubiquitous.** After deploying connectivity in most cities worldwide and providing smartphones to nearly 3.2 bn people worldwide, connected solutions and smartphone apps have an increasingly important impact on our individual behaviour. We control our smart home via apps, we move around in cities via apps, we shop online (and thus increase demand for urban logistics) – no matter where we are, data is able to inform our behaviour.

⁸ EIP SCC (2018): TOWARDS A JOINT INVESTMENT PROGRAMME FOR EUROPEAN SMART CITIES

⁹ Rifkin, Jeremy (2014)



Taken together, these two features – the zero marginal costs and the ubiquitous availability of data – may have a stronger impact on our cities in the future than classical infrastructure or urban planning ever had in the past.

The urban data economy

Apps are – in principle – automated algorithms connecting user-generated data in real-time; transferring it to information, which then triggers a specific behaviour by an individual. The more users an app has, the higher its impact on collective behaviour in cities, and because of the two digital characteristics – zero marginal costs and ubiquity – the design and functionality of the app become the determining factors in its diffusion instead of, for example, the size and service level of local staff, which is key for traditional urban services. This can lead to a situation where a company with barely 40 employees is able to run a taxi-app in virtually any city in the world, accumulating a market capitalisation of more than USD 5 bn. – like Uber did in its early years.

Companies design algorithms for urban solutions to a) maximise convenience for the end customer and b) maximise profits for the company. Delivering a sustainable solution to a city is usually of secondary concern, which is the reason why cities themselves need to start playing an active role as the curators of data and digital services. The “MyTaxi” app – for example – used to allocate taxi orders to taxi drivers based on their willingness to share their income. A taxi driver could opt to share anything between 3% and 30% of his income with the app-operator and would get more taxi calls by the app proportional to the percentage of his income he was willing to share with the company.¹⁰

On the customer side, this could mean that a customer would not get the vacant taxi closest by but the one paying the most to the app. An algorithm in an app thus has a tremendous impact on traffic in cities, since this on average increased the distance of trips to collect the customers. In Berlin – a city with 8000+ taxi drivers – this could easily add up to 40 000 unnecessary kilometres per day – including costs for infrastructure, health and the environment. Chicago – by the way – has 67 000+ Uber and Lyft drivers¹¹ and together these companies were worth close to USD 60 bn. in November 2019.

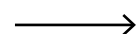
This potential imbalance between private returns and public costs from data-driven solutions is a key challenge cities face in the digital age. In addition, however, there is also great uncertainty on how to best deal with behaviour-generated and personal data in cities. On the one hand, most citizens are willing to make their personal data available to commercial third-party providers like Google, Facebook, Uber or others in return for a free or very convenient service. On the other hand, most citizens are sceptical or negative when it comes to the collection of data by public authorities – for example from sensors or cameras in the public space – or to combining personal data like, for example, household energy use with other data of relevance for the city. There is fear about potential government abuse of personal data, the possibility of surveillance and paternalism – and with authoritarianism on the rise in many countries this fear may be well justified.

Consequently commercial providers come into possession of an enormous amount of data (e.g. high-resolution information on capacity utilisation and movement in public transport systems), which is then made available to cities and municipalities for a fee. The users thus indirectly become customers of their own data. The behaviour of citizens becomes a commercially usable product in the context of the city, while the production and valorisation of the data remains opaque. This fuels fear and hesitation among decision makers, which in turn lead to falling short of harnessing the positive potential of data-based city applications as lined-out above. It is thus imperative to understand how cities and municipalities can play a more active role in the collection and application of (behavioural) data for the common good. In the broadest sense, it is necessary to define the data sets needed to inform future basic public services and that thus fall under public sovereignty.

These examples – the positive and the negative ones – demonstrate that data itself bears tremendous potential for sustainable, inclusive and improved cities, but it depends on our policies, governance and decisions

10 Lomas, Natascha (2014)

11 Chicago Tribune (2018)



whether we are able to put data to work in the best interests of the public. For making sure that data and digital solutions contribute to positive urban development we need to ask a simple question (and give a complex answer) any time a new data set comes into use for an urban operation: what value does it create for the city?

The following simple set of questions helps to formulate an adequate answer for an individual case:

- a) What is the positive impact of the digital solution on the city:
 - a. What are the direct and indirect benefits for citizens?
 - b. Does it reduce negative externalities? Which ones and how?
 - c. How does it improve the environment?
 - d. Does it contribute to the local economy in a positive way?
- b) What is the negative impact of the digital solution on the city:
 - a. What are the associated direct and indirect negative consequences?
 - b. Does it produce unnecessary risk?
 - c. Does it favour specific societal groups?
- c) What costs are associated with generating the data and operating the digital system to provide the digital solution?

Based on the outcome of this equation, a city might come to the conclusion to a) purchase the data, b) generate the data by itself, c) prohibit the particular service, d) provide the data openly to the public, e) procure a third-party service that runs on own data, etc.

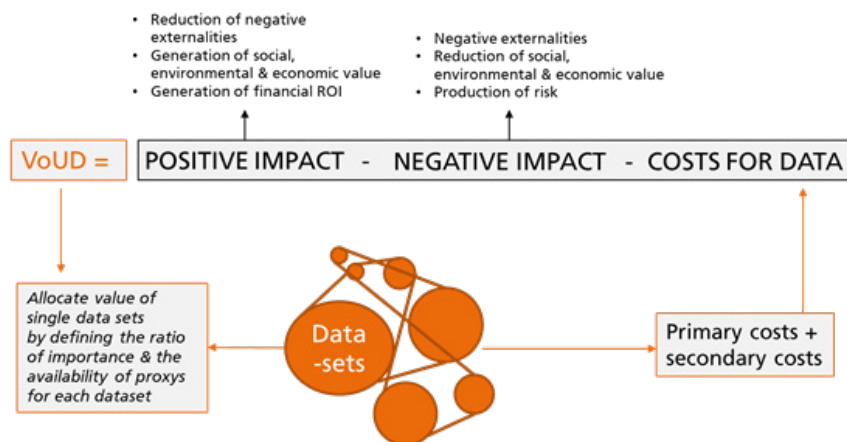


Figure 2: Assessing the value of urban data

The definition of the urban value, which sits within the combination of data sets, is one of the key tasks for cities in the years to come. Moreover, while we see this task arise on the horizon, we can witness the evolution of a new discipline that will eventually become a key component of any city council and municipal administration: Urban Data Governance!

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