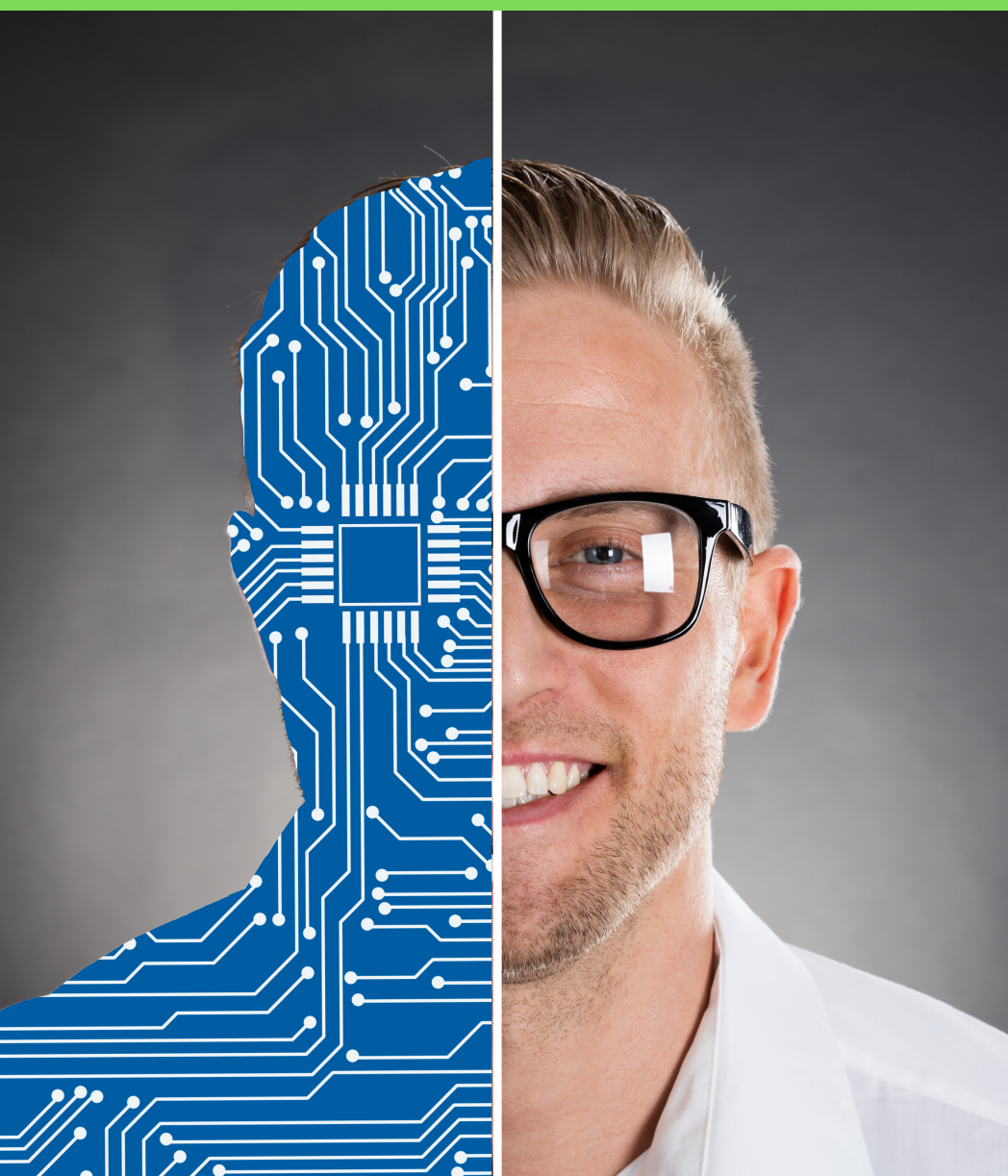


# DIGITAL URBAN EUROPEAN TWINS


*Change the way you see  
the city*



Prepared by Susie Ruston McAleer, Pasha Kogut (21c)  
Lieven Raes (Informatie Vlaanderen)



# ABSTRACT



*"Despite advances in data capture and management just 12% of city data is used for policy making"*

DUET is an Innovation project designed to leverage the advanced capabilities of cloud and high-performance computing (HPC) to help public sector decision-making become more democratic and effective, through the development of Digital Twins for policy exploration and experimentation across entire cities and regions.

DUET will enhance day-to-day city operations by helping managers react quickly to real-time events, and more easily harness the collective intelligence of ALL policy stakeholders to tackle complex, systemic policy problems which require innovative thinking to develop transformative solutions.



## CITIES FACE MANY DATA CHALLENGES

Cities are struggling to unlock value from their data due to a myriad of factors including, lack of data quality, consistency, accuracy, coverage, freshness, and completeness, plus a lack of data understanding (data literacy) to enable meaningful interpretation of data. Aside from the data itself, an overreliance on traditional analytics techniques, and lack of an infrastructure with the needed processing power to analyse the volume and variety of city data fast enough has also hampered progress.

Despite the economics of sharing hardware and software, in reality the costs for sending data to and retrieving it from the cloud is often more expensive than in-house storage. Data sharing and reuse also amplifies subtle and complex questions of interpretation, transparency, collaboration and trust that form a number of data ethics concerns, along with confusion around balancing the principles of 'openness' and 'privacy'.

Use of data must meet wider ethical requirements including; A clear public benefit; Use only to the extent proportionate to the need; Recognition of the limitations of the data used (including the risks of taking decisions on incomplete or inaccurate data) and; A precautionary approach, with transparency and accountability in the acquisition, processing, storage and use of data, i.e. ensuring algorithms driving HPC analytics are open and fair.

Together, these issues put many cities off publishing and sharing data, meaning many notable open data projects focused on enhancing city decision-making, never achieve their true potential for collaboration and innovation.





Public administrations seem destined to remain stuck in a world of pilots, with data literacy capacity remaining low, so their results rarely hit the mainstream the same way as private sector offerings do.

Imagine if cities could overcome these challenges and utilise lessons from the private sector that use fresh approaches to bring together existing and new data sources via an infrastructure which creatively aggregates them in a way that makes the data more valuable both in its quality and usefulness. A new Cloud enabled approach for the public sector that will aggregate city data adhering to legal and ethical principles, and intuitively make it easy to understand by all. An approach that removes concerns around ethics and skills and unlocks the real potential in open data for driving future decisions for cities whilst simultaneously enhancing today's city experience for all.

To take advantage of the increasing opportunities presented by vast amounts of city data for improving policy making three major barriers must be overcome:

**1. Lack of Access to Computing Power:** Cities need cost-effective access to high levels of computing power to creatively unlock tangible benefits from large quantities of different data, and enable real-time decision making.

**2. Lack of Data Literacy:** City data needs to be easier to understand for all through simple interfaces that enable everyone to understand the issue being addressed, and to be able to contribute ideas, thoughts, own data and feedback towards creating a more sustainable future

**3. Lack of Data Ethics:** As policymakers move towards using data from multiple sources, using new and creative data models, and advanced analytical techniques and easy to use tools, it is increasingly crucial to ensure that the way the data is collected and used conforms not only to the requirements of the privacy of personal data but also to the wider ethical principles.





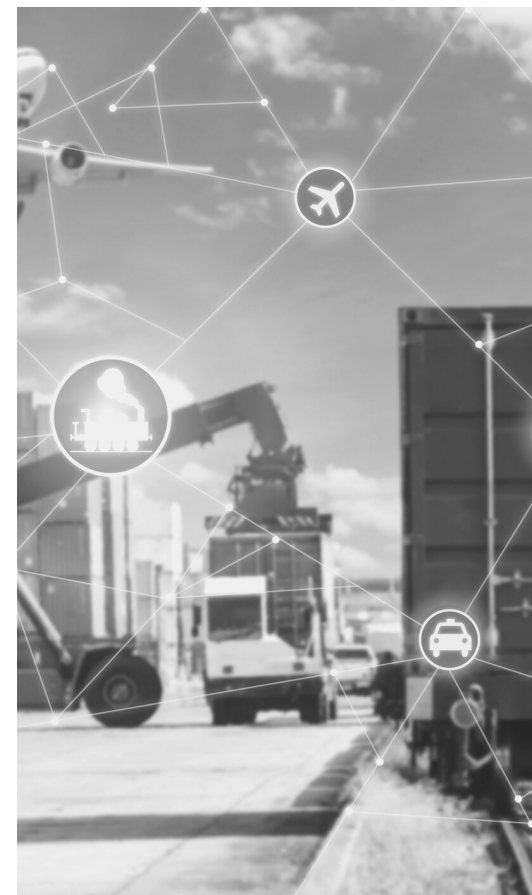
# DUET CHANGES THE GAME BY...

**1: Providing access to needed computing power:** Real-time city management needs algorithms and computing power that can scale to distil oceans of open data, deliver insights and maintain efficiency. Cloud computing offers the ability for cities to access highly scalable hardware and software resources for the overwhelming majority of IT use cases.

However, for future scenario predictions for policy modelling, cities need to execute heavy algorithms and leverage near real-time deployment and processing require the use of high-performance computing (HPC). Cloud computing has not been used for high performance computing (HPC) to the same degree as other use cases for several reasons, namely cost, but DUET will advance this area by providing a new shared approach for its use in policy making and city management – using a **Digital Twin**.

A “Digital Twin” is a new concept consisting of a continuously learning digital copy of real-world assets, systems and processes that can be queried for specific outcomes. DUET (Digital Urban European Twins) will consume Open Data and Data models from different sources in the city and integrate them with new technology capabilities including HPC, Artificial Intelligence and Advanced Analytics in order to provide a replica city environment where policy experimentation can safely take place. By predicting asset behaviour and capacity to deliver on specific outcomes within given parameters and cost constraints, the Digital Twin provides a risk-free experimentation environment to inform stakeholders what they need to do with the assets in the real-world in order to both achieve the most effective long-term policy outcomes, and short-term operational decisions.

**2: Making data easier to understand:** Easy to understand visualisations are a critical factor for driving trust in using



data for democratic decision making. However, most visualisation platforms still need a degree of geo-expertise to truly use them to extract intelligence. DUET is different as it provides a 3D interface for its Digital Twins alongside a 2D offering. Users, regardless of their technical or academic background, will be able to walk through DUET's virtual 3D city neighbourhoods, and directly see dynamic data readings from multiple sources in a familiar context that makes them easy to understand. For example, users may see air quality through colours, traffic congestion as lines, incident sites as icons and so on. This simple, relatable way of viewing the city through multiple integrated data sources brings to life the tangible, systemic impacts of policy options, fueling 'what if' experimentation that unleashes creative and innovative qualities of all participants. This levelling of the field means that policy makers, administrative workers, emergency services, entrepreneurs, businesses and citizens can all participate in co-creation and consultation exercises as part of the traditional policy making cycle.

### **3: Establishing Ethical Principles for Data-Driven Decisions:**

The game-changing, cloud based, Digital Twin infrastructure with its deep-dive visualisation platform for policy experimentation will boost collaboration and policy innovation and bring new discoveries and intelligence through novel views of the data.

Using visualisation tools, analysis of problems can have greater depth as many multi-disciplinary and multi-sectoral layers of data relating to the physical and social world can be considered together. Using a Digital Twin users can explore policy impacts across a whole city, rather than just one or two small localities. Instead of providing complicated graphs and multiple versions of maps from different industries to illustrate the impacts of, for example road routing decisions on mobility, air quality and health, the Digital Twin provides one version/replica of the city for all to use as a trusted baseline for exploring systemic impact of decisions. Visualising multiple data sources through the Digital Twin make relationships more apparent, dependencies and interactions more clearly viewed and the trade-off between a variety of possible solutions can be modelled and evaluated.

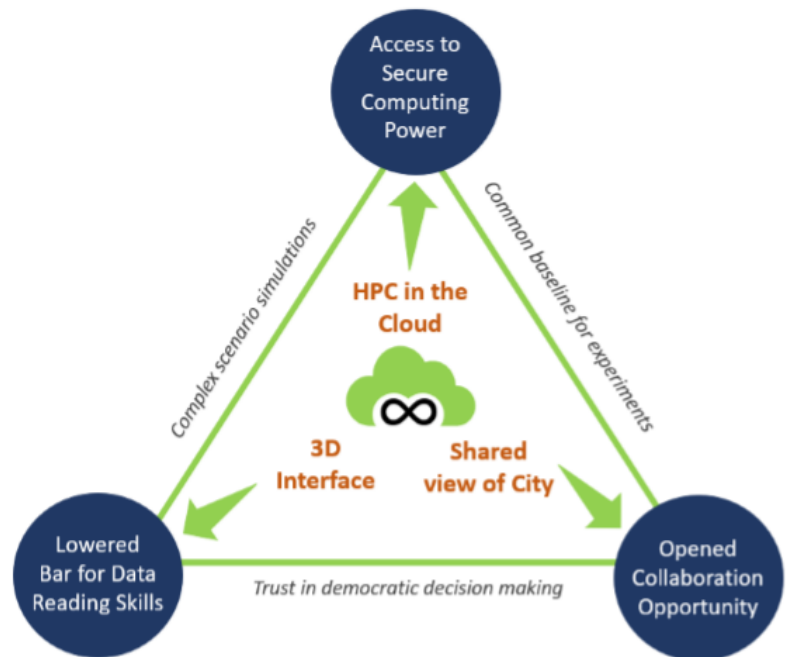




## DUET'S AIM

Digital Urban European Twins (DUET) is a H2020 funded project designed to advance policy development in the age of big data and cloud to deliver a trusted, scalable and transferable solution for accelerating the adoption of data-driven, collaborative decision making and policy making.

It is designed to stimulate the creation of collaborative and innovative solutions to multi-disciplinary and multi-sectoral societal challenges by making it easier for policy makers and their stakeholders to access, visualise and use a wide variety of big geo-data sources to explore and co-create policy in the key Horizon 2020 target areas of transportation, environment and health.



## THREE MAIN OBJECTIVES

**01****INNOVATION**

Create a cloud and HPC enabled Digital Twin approach for collaborative policy making

**02****EXPERIMENTATION**

Test Digital Twin approach for more effective policy experimentation

**03****SUSTAINABILITY**

Ensure wider impact through the scalability and transferability of outcomes

## THREE PILOT CITIES

### LARGE METROPOLITAN

## ATHENS

Embrace Digital Twin use to understand city relationships and overcome engagement barriers with stakeholders; Create new business value based on data-driven insights; Co-create digital services with the active engagement and participation of citizens; Improve effectiveness of policy design and implementation.

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### CITY

## PILSEN

Develop a set of tools dedicated for policy support in urban design including traffic and noise pollution modelling tools, visualisation tools, a sensor data orchestrator and social media analytical tool. The visual insights will provide data-based evidence for policy making.

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### REGION

## FLANDERS

Vision to create a Smart Region where everyone can access services and data, and cross-silo cooperation is encouraged. Citizens and companies become active in policy-making processes to improve the quality of decision making and acceptance of the outcomes.





## BEST OF BREED CONSORTIUM

*Benefits  
realisation  
experts*



*Data modelling  
professionals*



*Technical specialists  
for digital twin  
innovation*



*User needs  
and pilots*



*Protect users*



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This paper represents the view of the DUET project only.

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