

URBAN CONFERENCE AND LAUNCH OF COMMUNITIES OF PRACTICE (CoP)

Smart City and Digital Twins to plan Cities

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25 April 2023



Implemented by



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An aerial view of a dense city skyline, likely New York City, with numerous skyscrapers and buildings. Overlaid on the image is a network of white lines connecting several bright, glowing nodes, symbolizing a digital or data network. The nodes are positioned at various points across the city, suggesting a global or city-wide connectivity.

Digital Twins to Plan Climate-Resilient Cities

Case 1: Smart Cities Disaster Prevention

Real-time artificial intelligence can predict where, when, and what climate events occur to monitor and predict disasters.

- **Main objective and purpose:**
 - To bring an innovative climate adaptation strategy to operation, understanding risks and impacts to support a proactive and assertive decision.
- **Target group:** Government by the municipal/federal/district civil defense.



A vehicle passes through a flooded street. All the major roads are flooded after the heavy rain during monsoon at Kolkata, West Bengal, India (Dibakar Roy/Pacific Press/LightRocket via Getty Images)

Case 1: Smart Cities Disaster Prevention

- **Main functions:** A cloud platform where the users can see the forecasts, predictions, monitoring, and AI results.
- **Artificial Intelligence:** An AI-Solution can predict where, when, and what types of climate events will occur and can automate proactive, resilient, and assertive decision-making.
- **Contextualization:** To provide information on the context and what you need to do before the event occurs, enhancing resilience and reducing damage and loss.
- **Innovation and Adaptation:** To bring an innovative climate adaptation strategy, understanding risks and impacts to support proactive and assertive decisions.



Case 1: Smart Cities Disaster Prevention

- **Implementation complexity:**
Medium complexity
- **Implementation cost:**
Contribute to cost reduction, bureaucracy reduction, response time reduction, and operational activity optimization.
- **Why data-driven decision-making through this case may be interesting for the Smart City in the Indian context?**
Improved onboarding of staff and accessibility of training providers.
- **More information and links:**
<https://www.sipremo.com/#services>

70%

Climate Change impact

70% of businesses are impacted by climate change

90%

Knowledge and proactivity are crucial

Of businesses cannot understand what weather data means for them

-10%

Financial Losses

Global economy could lose 10% of its total economic value by 2050 due to climate change.

216mm

Social damages

The number of people who will be affected by 2050 because of climate change.

Case 2: Digital Twins

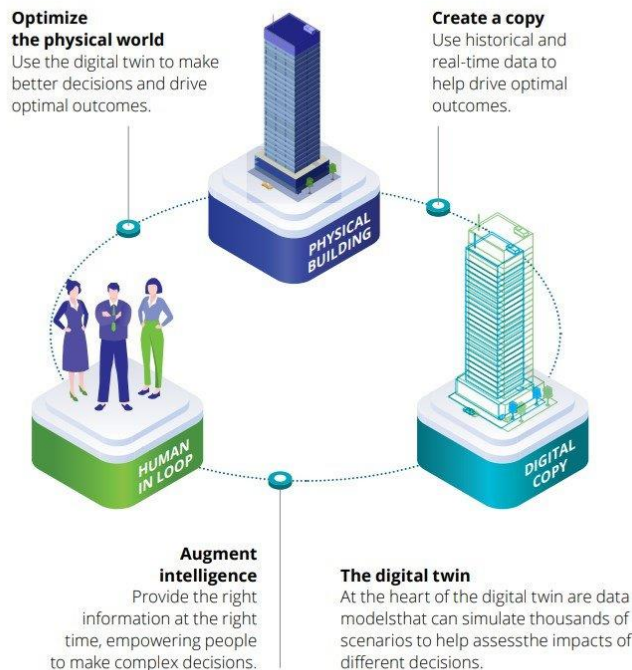
A digital twin (DT) is a detailed and dynamically updated virtual replica of physical objects or processes, made to monitor performance, test different scenarios, and find optimization opportunities.

- **Main objective and purpose:**

- Government agencies effectively analyze what can be done with the data and improve citizen living and create economic opportunity.
- Bringing the virtual and physical worlds together can help to better inform decision-making, reduce risk, and acts as a citizen engagement tool.
- With open data, Cities then can become more democratic and has the potential to actively contribute to achieving the UN -SDGs.

“A digital twin is the combination of a computational model and a real-world system, designed to monitor, control and optimize its functionality”.

Source: IBM



Best practices Smart Cities

Case 2: Digital Twins

■ What is Operational Intelligence (OI)?

- A Digital Twin is a model of a physical asset that uses OI to apply advanced analytics, machine learning, and AI in order to receive real-time insights about the physical asset's performance.

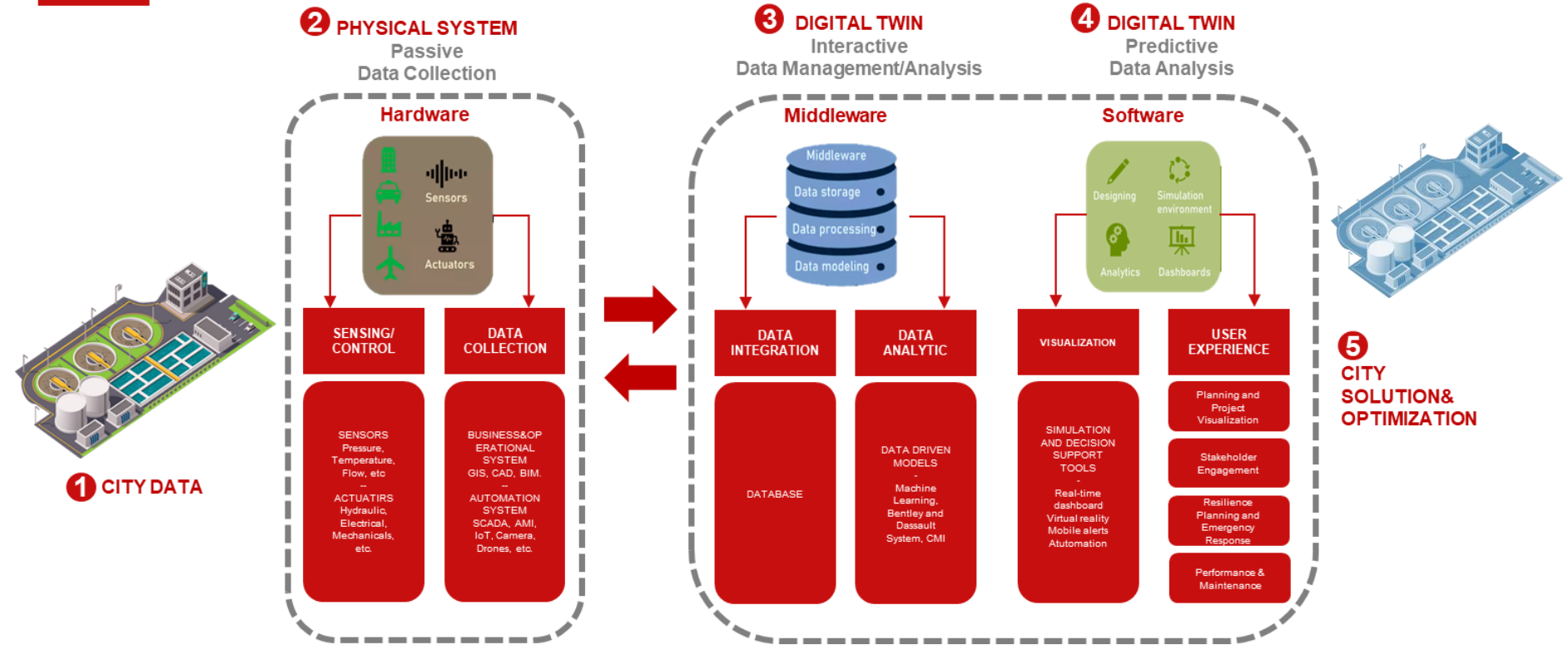
■ Main Digital Architecture:

- Digital Twin adopts hundreds of IoT systems and public databases which are consolidated into a single portal creating a **“DIGITAL TWIN PORTAL”** of the city.
- **Hardware Components.** The Internet of Things (IoT) sensors, that initiate the exchange of information between assets and their software representation.
- **Data Management Middleware.** Its simple element to accumulate data from different sources.
- **Software components.** The crucial part of digital twinning is the analytics engine that turns raw observations into valuable business insights.



Case 2: Digital Twins

Digital Twin Architecture



Case 2: Digital Twins

Types of digital twins

The difference between different digital twins within a system or process.

1. Component twins/Parts twins

- Component twins are the basic unit of digital twin, the smallest example of a functioning component.

2. Asset twins

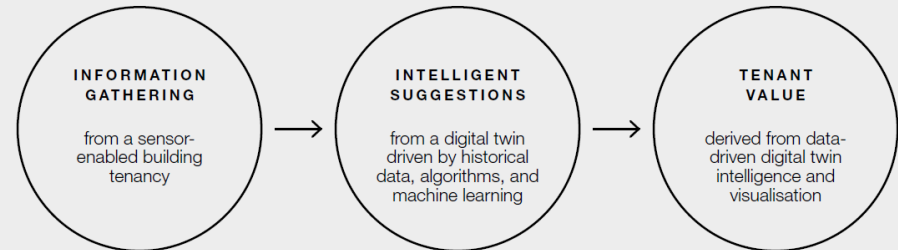
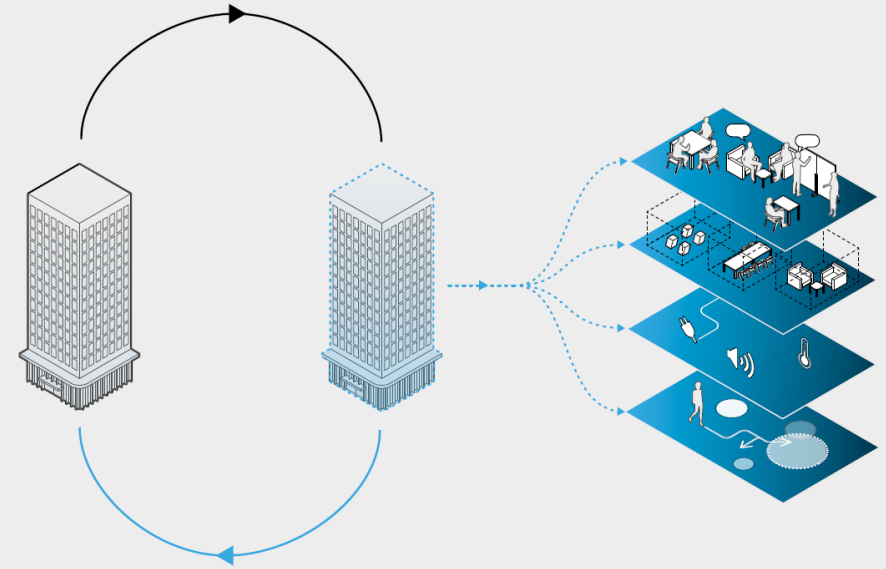
- When two or more components work together, they form what is known as an asset.

3. System or Unit twins

- The system enables you to see how different assets come together to form an entire functioning system.

4. Process twins

- Process twins reveal how systems work together to create an entire production facility.

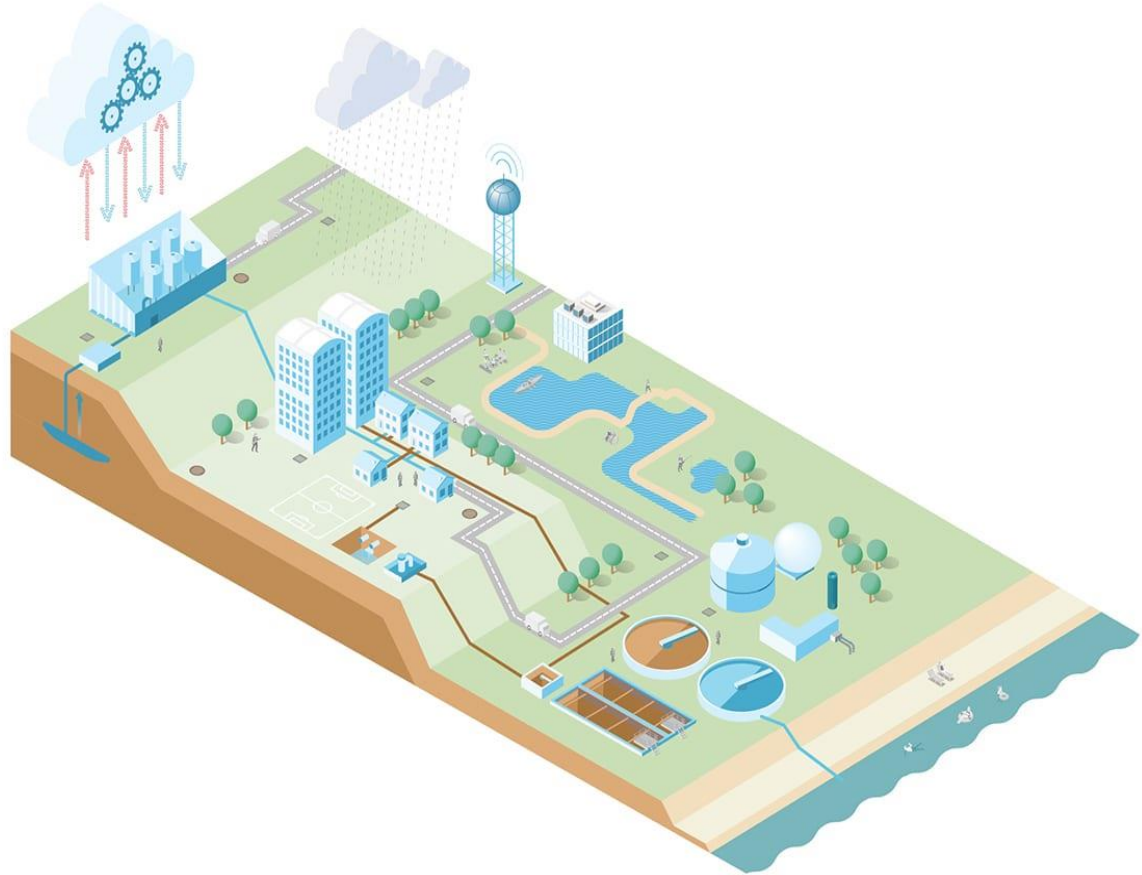


Case 2: Digital Twins

Sector of Application

Digital twins are already extensively used in the following applications:

- **Digital Twin in Municipal Utilities:**
 - Water utility companies can use digital twins for an uninterrupted water supply to be better prepared during emergencies.
- **Power-generation equipment: Designing and manufacturing complex products like cars, jet turbines, airplanes.**



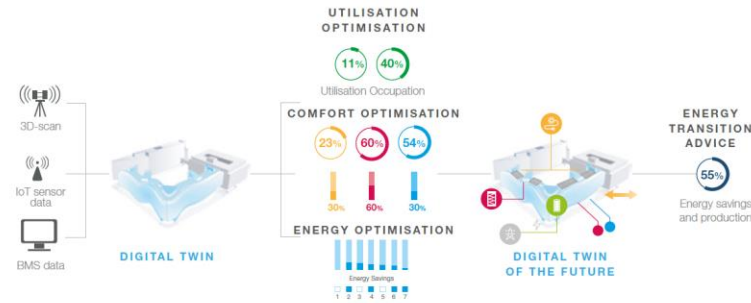
The Hague's County Hall and the core components of the digital twin The digital model for The Hague's County Hall

Case 2: Digital Twins

Sector of Application

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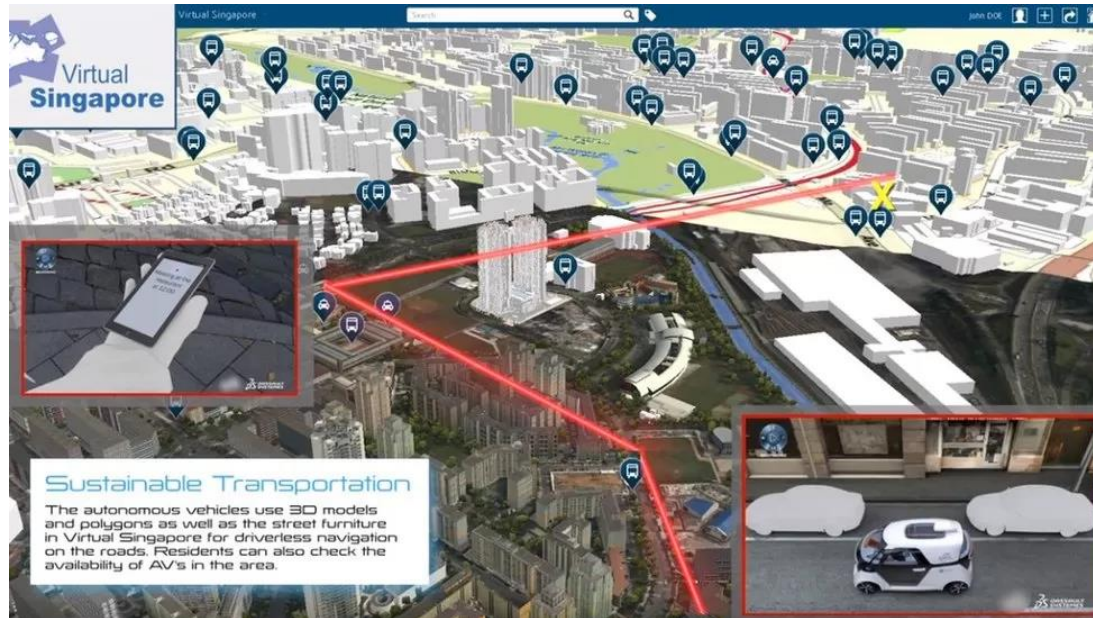
- **Structures and their systems**
 - Big physical structures, such as large buildings or offshore drilling platforms, are useful in designing the systems operating within those structures, such as HVAC systems.
- **Urban planning: Construction of buildings, bridges, drilling platforms, and other large objects.**
 - Civil engineers and others involved in urban planning activities are aided significantly using digital twins, which can show 3D and 4D spatial data in real-time and incorporate augmented reality systems into built environments.



The Hague's County Hall and the core components of the digital twin The digital model for The Hague's County Hall

Case 2: Singapore Digital Twin

"Virtual Singapore is a 3D digital twin of Singapore built on topographical as well as real-time, dynamic data". Virtual Singapore is a dynamic three-dimensional (3D) city model and collaborative data platform, including the 3D maps of Singapore.



The real Singapore has been faithfully recreated in virtual form



Case 2: Singapore Digital Twin

Uses of Virtual Singapore

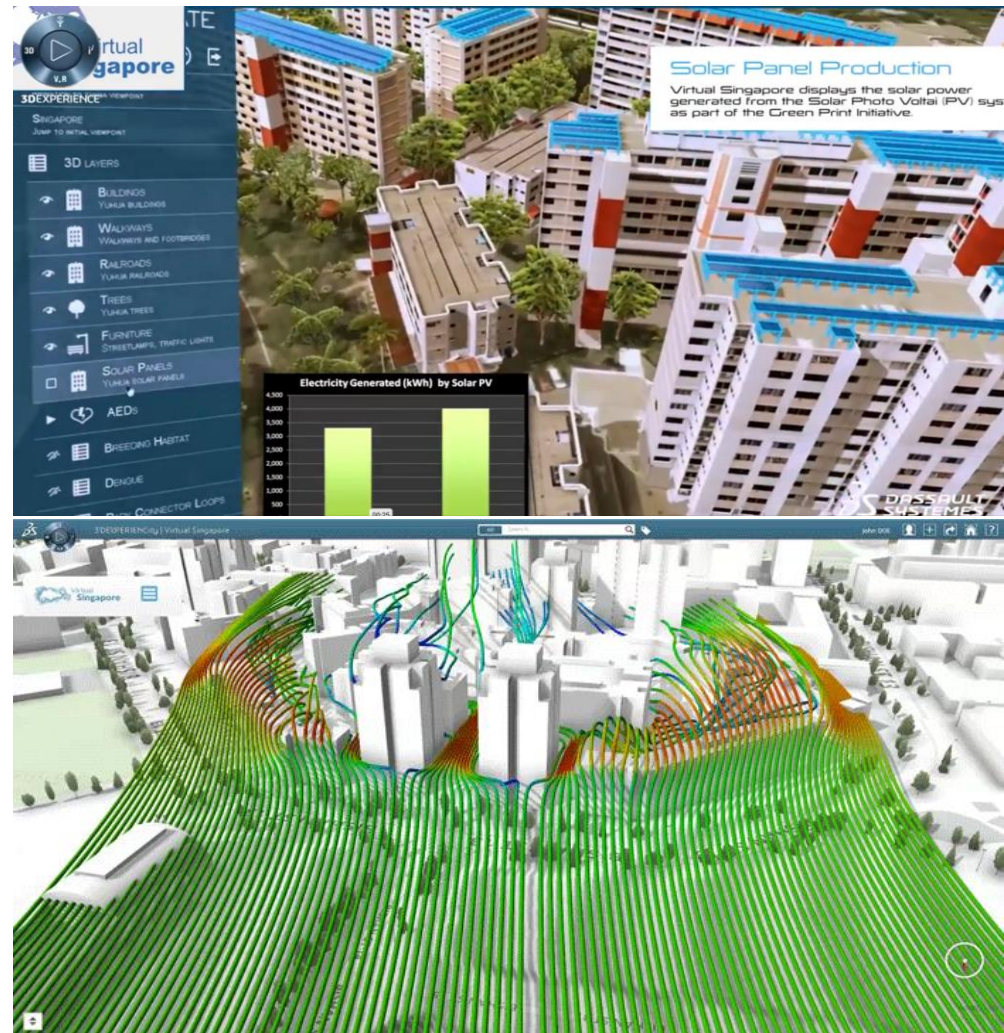
- **Planning and Decision-Making**
 - Virtual Singapore makes it possible to visualize the existing landscape against ongoing/future upgrading or renovation projects.
- **Improved Accessibility**
 - Virtual Singapore can provide an accurate representation of the physical landscape, to identify and show barrier-free routes for the disabled and elderly. They can easily find the most accessible and convenient route, and even sheltered pathways, to the bus stop or MRT station.



Case 2: Singapore Digital Twin

Uses of Virtual Singapore

- **Urban Planning**
 - Urban planners can visualize the effects of constructing new buildings or installations.
 - Data such as the height of buildings, the surface of the rooftops, and the amount of sunlight are available in Virtual Singapore.



Case 2: Singapore Digital Twin

Benefits to Stakeholders

Virtual Singapore will enable public agencies, academia and the research community, the private sector, and also the community to make use of the information and system capabilities for policy and business analysis, decision making

- **Government**

- Virtual Singapore is a critical enabler that will enhance various WOG initiatives (Smart Nation, Municipal Services, Nationwide Sensor Network, GeoSpace, OneMap, etc).

- **Citizens and Residents of Singapore**

- Through Virtual Singapore, the provision of geo-visualisation, analytical tools and 3D semantics-embedded information will provide people with a virtual yet realistic platform to connect and create awareness and services that enrich their community.

- **Businesses**

- Businesses can tap on the wealth of data and information within Virtual Singapore for business analytics, resource planning and management and specialised services.

- **Research Community**

- The R&D capabilities of Virtual Singapore allow the creation of new innovations and technologies for public-private collaborations to create value for Singapore. Amongst other new research areas, semantic 3D modelling is an emerging area, where research and development is needed to develop sophisticated tools for multi-party collaboration, complex analysis, and test-bedding.

Case 3: Smart Monitoring Spain

Main objective:

This solution allows for managing all **Government – Citizen communication** on Social Media using a single dashboard.

Target group:

City's Communication Department, Public authorities, Entrepreneurs

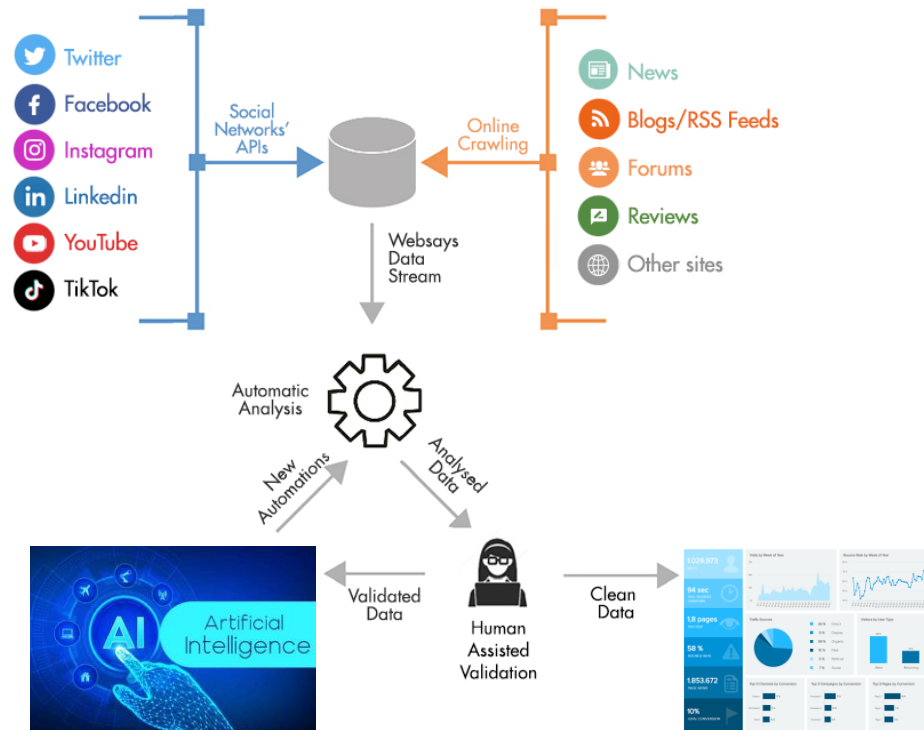
Main functions:

- The Dashboard's AI discovers opinions and popularity of discussion topics.
- Allows for data-driven decision making.

This technology is already implemented in city councils such as Barcelona, Tarragona, and Sant Feliu de Llobregat (near Barcelona).

More information and links:

<https://websays.com/en/about>



The dashboard helps you manage and respond to millions of mentions in the most easy way

Listen to your citizens!

Case 3: Smart Monitoring Spain



Can decision makers in municipalities or the public rely on dashboards for **people-centric decision making**?

Rather no, if data silos must be aggregated. Data validity and up-to-dateness is a big problem usually.

Yes, if the data and the dashboards are generated directly from activities performed by...

- a software (see previous example)
- a hardware (e.g. a robot).

Thank You