



GOOD PRACTICES

Development of a 'Digital Urban Twin Platform' in Bağcılar, Türkiye

DIGITAL DISASTER PROTECTION AND INNOVATIVE MUNICIPAL RISK MANAGEMENT

Commissioned by



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Overview

Since the 2000s, the Bağcılar municipal administration has been developing a digital platform that maps the municipality's urban structures as a 3D model. This involves integrating various data sources, such as street cameras, geographic information systems (GIS), and municipal data, using LiDAR-based 3D city modeling and artificial intelligence. With this model, the city administration makes predictions about risk scenarios, thus supporting disaster preparedness as well as numerous other areas of urban planning, such as infrastructure management.

Background

Bağcılar is one of Istanbul's most densely populated districts, with approximately 710,000 inhabitants. Located on the coast of the Sea of Marmara, it covers an area of about 22 square kilometers. As a municipality in a region with a high risk of earthquakes, Bağcılar faces the urgent task of implementing emergency preparedness measures to protect its population and urban systems. To achieve this, the city administration first and foremost needs a comprehensive overview of the building stock and the material condition of urban infrastructure.

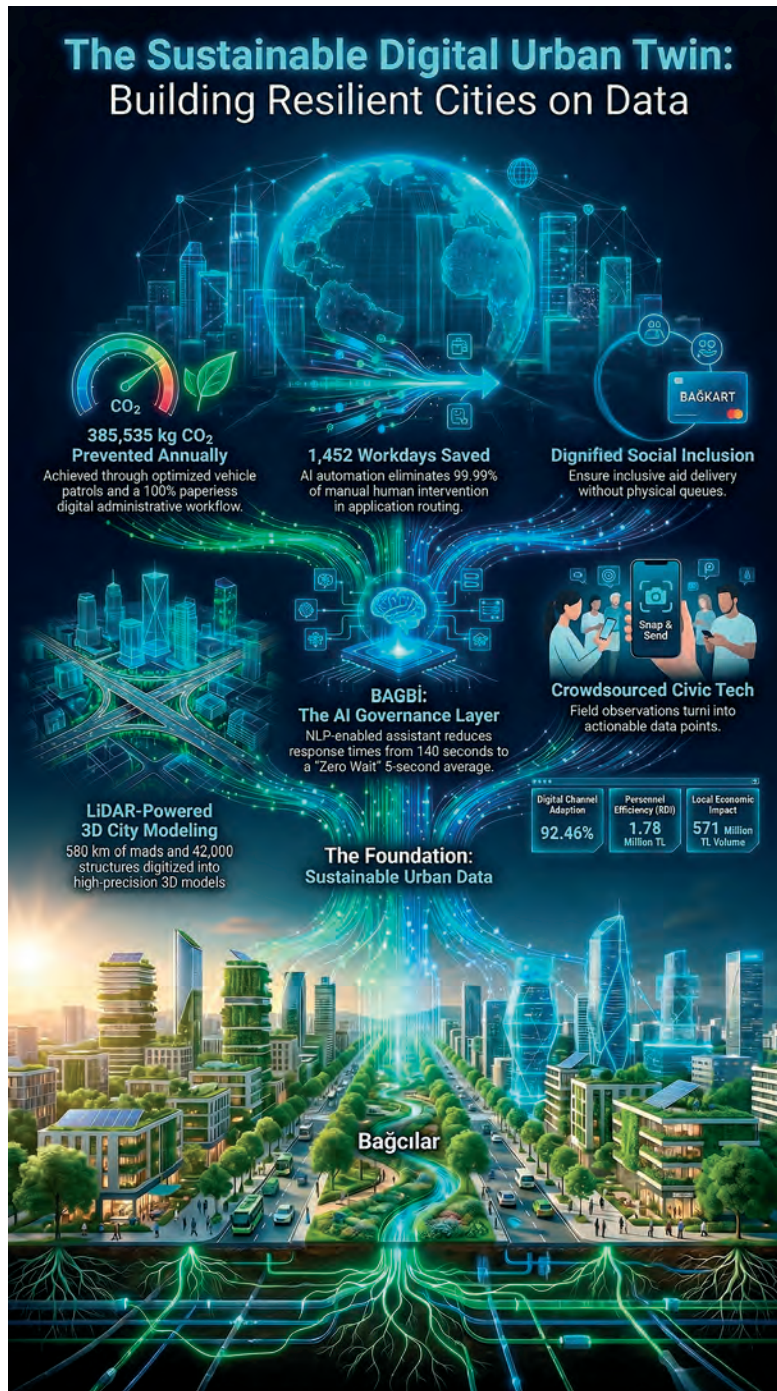
Traditional data collection methods required extensive on-site visits and manual processes, which in the past led to fragmented information and duplication of effort between departments. To increase efficiency and create a shared understanding of the situation, the administration launched a long-term digital transformation process, which ultimately resulted in the 'Digital Urban Twin Platform'. This initiative evolved from a broader city administration strategy aimed at improving both services for residents and municipal decision-making through data-driven analytics.

Building a Sustainable Digital Urban Twin for resilient, risk-informed and data-driven municipal governance in Bağcılar.

Photo: Bağcılar Municipality – Information Technologies Department

Objectives

The Digital Urban Twin Platform is the result of an ongoing digitization process that has led to the development of a data management system for municipal infrastructure. Using a continuously updated database, which already encompasses over 42,000 urban structures, the platform aims to enable municipal authorities to assess situations more quickly in emergencies and disasters. Furthermore, the ongoing digital monitoring of the building stock's condition allows for targeted on-site inspections regarding compliance with building regulations (approved/unapproved, risky/safe, etc.).



The platform also aims to provide the necessary infrastructural support for a current, real-time inventory of buildings in the city, as well as for strategic urban management. At the administrative level, the platform integrates various departments, thereby strengthening administrative coordination in disaster preparedness and urban management.



Integration of earthquake-related datasets and emergency information layers to support risk-informed municipal planning and urban resilience. | Photo: Bağcılar Municipality

Activities

1. As early as the beginning of the 2000s, the Bağcılar administration began actively advancing the digitization project. Initially, a needs analysis was prepared with the involvement of local stakeholders in order to initiate the technical planning and procurement processes.
2. In the subsequent data acquisition phase, Bağcılar relied on a combination of LiDAR surveys using laser scans, mobile mapping measures, and the acquisition of street panorama images and geodata.
3. In the third step, a digital inventory was created from the resulting databases and the digitization of historical archives, in which municipal facilities, residential and commercial buildings, and other urban structures are presented in a standardized format. Additional validation measures are necessary to ensure high data quality.
4. From the meticulously maintained inventory, the Digital Platform was finally developed starting in the 2020s. This comprehensive Smart City Management innovation includes not only the Digital Twin but also an app-based service system for citizens. For example, Bağcılar's residents can interact with a chatbot to access information and services from the municipality at any time.
5. To expand the application possibilities of the Digital Twin in risk-informed urban development in the future, several functions are currently being developed: flood simulations, shadow analysis, visibility analysis, studies on urban heat islands, IoT dashboards, energy forecasts and AI-supported analyses.

Mobile mapping and LiDAR data acquisition used to generate high-precision 3D city models for the Bağcılar Digital Urban Twin Platform
Photo: Bağcılar Municipality

Results

Progress in establishing the digital 3D city model can be summarised as follows:

- Integration of more than 42,000 buildings
- Digitisation of more than 40,700 archived building records and over 27,500 elements of the urban fabric
- Collection of more than 580 kilometres of mobile map data and panoramic images covering all 22 districts of Bağcılar
- Integration of 52 IoT sensors and monitoring devices into municipal operations
- Creation of a shared digital environment for various municipal departments
- More than 707,000 citizens benefit indirectly from the digital administrative infrastructure





The Digital Urban Twin Platform combines 3D city models, municipal datasets and thematic layers to support evidence-based decision-making at local authority level. | Photo: Bağcılar Municipality

Results

THE NEED FOR A SUSTAINABLE DATA BASIS

One of the most significant challenges in digital urban twin projects is ensuring that the digital model operates continuously, accurately, reliably, and sustainably. The local administration has made this a core objective by creating a comprehensive and cleansed database of its building stock prior to developing advanced digital twin functionalities.



Emergency assembly areas visualized within the Digital Urban Twin Platform to strengthen disaster preparedness and emergency response planning. | Photo: Bağcılar Municipality

Since much building data existed primarily as files and scanned documents, the information they contained had to be converted into cleansed datasets. This resulted in more than 40,000 buildings being linked with verified building identities and standardized building data. This process transformed the city's archives from document repositories into a strategically applicable knowledge database.

The resulting building inventory now serves as a reference level for the Digital Urban Twin Platform, ensuring consistency between the digital model and the physical city. This same data structure also enables integration with municipal information systems, land registry and tax data, citizen services, infrastructure management systems, and future smart city applications. This data-centric approach ensures that the Digital Urban Twin remains sustainable, continuously updatable, and operationally valuable in the long term.

The Digital Urban Twin Platform has brought important advantages to the city administration:

1. BETTER DECISION-MAKING

Municipal departments now have access to standardized and up-to-date spatial information, enabling more informed decisions in both short-term and long-term applications. The platform also provides a digital foundation for future risk analyses, emergency planning, and disaster management applications.

2. INCREASED EFFICIENCY

Digital visualization and remote inspection capabilities reduce the need for repeated on-site visits and improve resource allocation. Furthermore, different municipal departments can work with the same datasets and visual environment, thus improving institutional coordination.

3. RESILIENCE OF DATA-DRIVEN ADMINISTRATION FOR THE FUTURE

The project has strengthened the city administration's ability to leverage data as a strategic advantage for planning, monitoring, and service delivery. The platform thus creates a solid foundation for future AI applications, IoT integrations, and advanced urban analytics.

Building-based information management integrating cadastral, address, permit and municipal records into a unified Digital Urban Twin database. | Photo: Bağcılar Municipality



Conclusion

Bağcılar's Digital Urban Twin Platform combines LiDAR-based 3D urban modeling, mobile mapping, panoramic street images, Geographic Information Systems (GIS), municipal information systems and future applications of artificial intelligence in a single integrated environment.

The "Digital Urban Twin Platform" is not an isolated technology project, but a long-term strategy for digital transformation that supports risk-aware urban development and evidence-based decision-making.

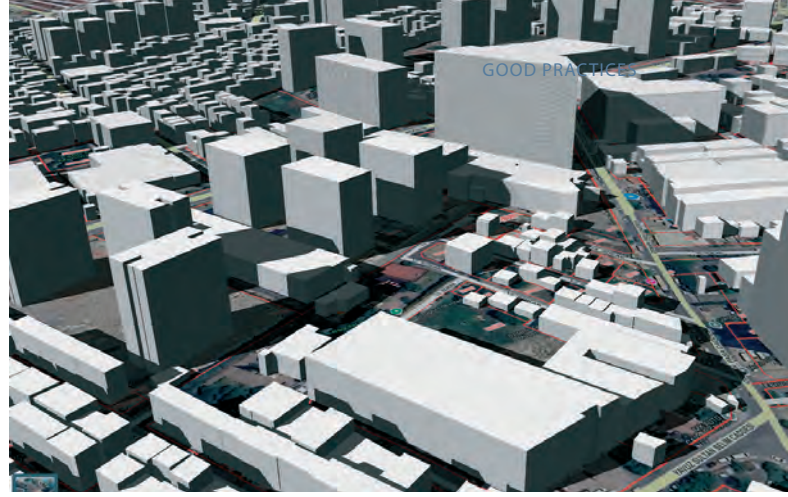
„A sustainable Digital Urban Twin begins with sustainable city data.“

A central principle of the project

In retrospect, the progress of the project depended primarily on secure political and institutional support, which was achieved by communicating a clear and long-term vision for digital transformation vis-à-vis decision makers.

Thereby, the implementation process required both continuous collaboration between participating departments and the integration of various technologies to bring the platform into operation.

Analysis of solar radiation and the energy potential of buildings to support sustainable energy planning and climate-resilient urban development. | Photo: Bağcılar Municipality



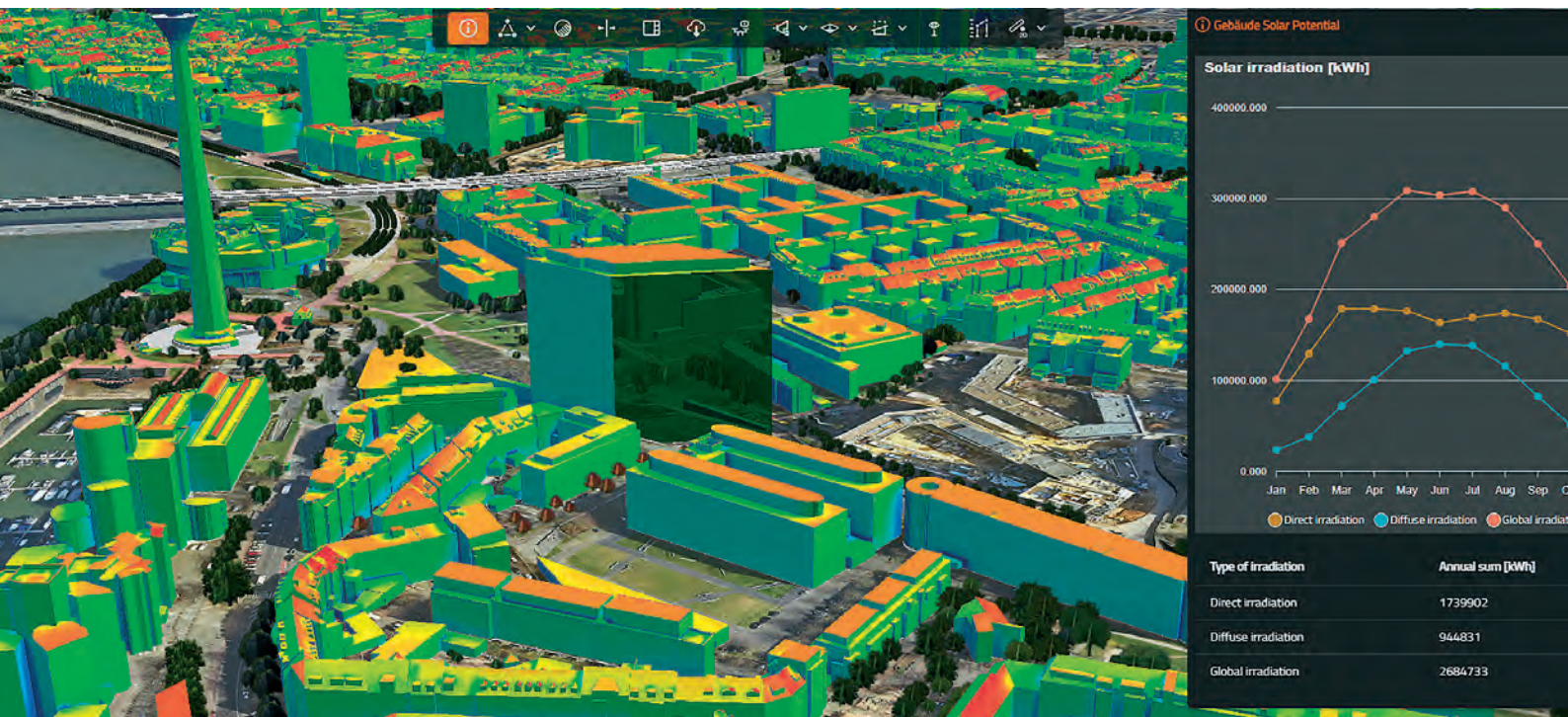
Shadow analysis to support sustainable urban planning, environmental impact assessments and the development of future scenarios. | Photo: Bağcılar Municipality

Reliable and regularly updated city data, as well as a step-by-step implementation that is geared towards the practical needs of the city's residents, ensure the functionality and applicability of the Digital Urban Twin now and in the future.

The municipality's long-term vision is to create a fully integrated urban management environment that combines GIS, digital twins, artificial intelligence, IoT technologies and municipal information systems to support sustainable and resilient urban development.

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Since 2013, Connective Cities has been promoting the worldwide exchange of municipal expertise. Within the framework of structured learning processes, the platform disseminates proven-practice solutions for sustainable municipal development and supports peer learning between German and international municipal experts, as well as the joint development of project ideas.

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