# Digital twins at the heart of Egis´ technology knowhow

Digital twins are an emerging technology in the AECO (Architecture, Engineering, Construction and Operation) and administration sectors, often under very different guises. But why have they been so slow to catch on? Firstly, their deployment requires careful planning, and the readiness to co-construct with the future beneficiaries using the available building blocks. Also, because the skills they mobilize occupy the frontier between the digital world and the traditional engineering professions, as well as the management/maintenance field. All dimensions to which our teams are devoting a lot of attention in the creation of the new digital twins and service offering from Egis.

Nicolas Ferrara
Digital twins and BIM expert, Egis Group

So what is a digital twin? First used in the aerospace industry, digital twins are models created to describe and represent (in 2D, 3D etc.) physical assets such as buildings (stadiums, hospitals, stations, underground utilities etc.) and natural patrimony (water, air, fauna and flora, noise etc.). These models are regularly "synchronized" with their physical twins using field data. Essentially conceived for non-experts, providing a hub for collaboration between different teams, digital twins offer a shared, 360° vision of a physical asset and its surroundings. When connected to dedicated professional tools, digital twins enable closer monitoring of an asset, facilitating decision-making by allowing us to foresee or predict impending problems and simulate crisis scenarios. Providing a kind of "x-ray vision" to safety consultants, investment planners, equipment maintenance teams, and more.
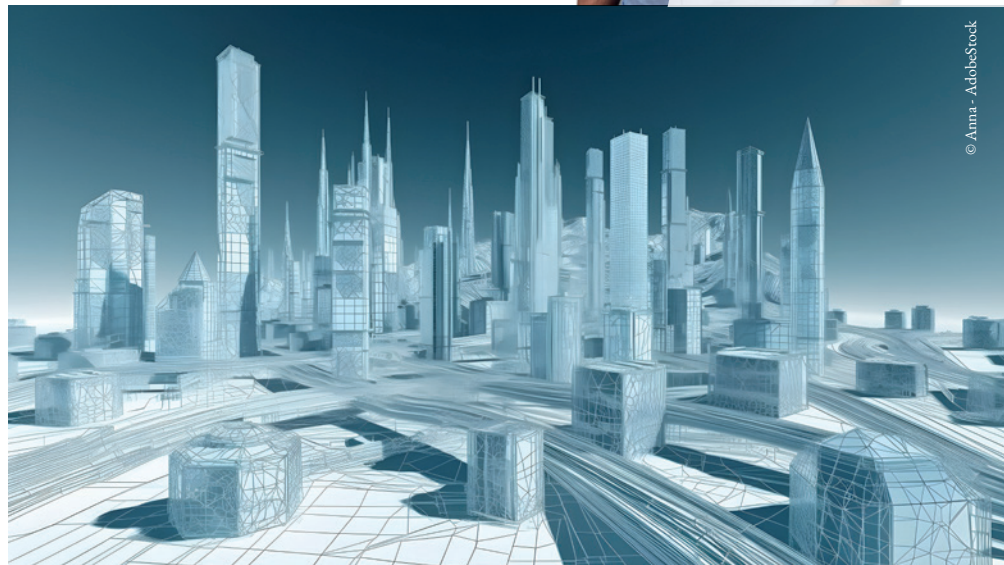
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However, there's still a long way to go. Although Egis has been working for over ten years on the development of new approaches to building information modelling (BIM)* and geographic information systems (GIS)* (we invested €50m in digital technology in 2023), no digital twin is conceived, built or operated in isolation.

That's why Egis has decided to add three new services to its catalogue as complements to its historic portfolio:

Digital consulting

Integration of digital twins

Operation of digital twins

Digital consulting at the service of industry and communities

The introduction of digital twins can be a disruptive influence on existing working practices and procedures. The transparency that digital twins enable, in the form of point clouds and digital models, can signify considerable upheaval for experts and engineers who previously enjoyed a monopoly on this information. Also, in large organizations the deployment of a digital twin often provides the opportunity to re-think data circulation in a bid to break the silo mentality which can prevail in certain sectors.

For this reason, the introduction of a digital twin is more likely to succeed when it's preceded by a design phase which addresses the "whys" and the "hows" without aggressively pushing the technology or casting it as one more "tool by engineers, for engineers".

Therefore, Egis has developed a digital consulting offering designed for public authorities and management/maintenance professionals who find themselves faced with the challenges that digital transformation poses: such as the need to facilitate the circulation of information among their teams, improve data collection, or to make better use of models and technologies such as BIM and GIS.

We put together a team of fifty engineers and architects who are equally at home in both worlds - virtual and physical - to develop this offering. Their common denominators?

1. Tried and tested engineering/operational skills and knowhow in key Egis activities including transport and mobility, built environment, aviation, water, energy, and strategic consulting.

2. The ability to provide engineering consultancy services and a good comprehension not only of the existing architectures but the emerging digital technologies in the sector (BIM, PLM, asset management, AI etc.)

3. An approach which demystifies new technology and encourages users and groups to engage with it, identify problems, and find solutions.

4. A good vision of the applications of digital twins and ways to implement them.

Integration: the key to faster deployment of digital twins

Having observed attempts to deploy and debug all-in-one digital twin solutions that were long, costly and held in low regard by operation and maintenance professionals, in 2020 Egis decided to try a different approach. This was to connect the applications already in place in organizations (CMMS, DMS, ERP, GIS etc.) via platforms enabling them to exploit the wealth of information contained in digital models (BIM), point clouds, and the signals from IoT (Internet of things) sensors.

In 2020, Egis connected a BIM system to a GIS system to offer services ranging from diagnostics and fault detection to supervision and maintenance support for road tunnel and viaduct projects (the OTAN tunnel in Brussels and the Candaba viaduct, Philippines). In 2021-22, our teams were busy on

GLOSSARY

CMMS: computerized maintenance management system

EDM: electronic document management

BIM: building information modelling

GIS: geographic information system

ERP: enterprise resource planning

PLM: product lifecycle management

AI: artificial intelligence

DID YOU KNOW?

Egis has already carried out a number of consultancy projects for major clients such as Aéroports de Paris, SIAAP, the operator of the Paris sewerage network, BrucePower and Métropole Européenne de Lille (MEL).

In the first half of 2023, this local authority launched a project to enable its departments to make greater use of BIM models and GIS maps.

Egis was selected because of its own experience in the BIM transition and its ability to design and run workshops aimed at bringing priority issues to the fore. These workshops helped to bring to light the problems of collaboration, reluctance and misunderstanding, while providing the beginnings of answers and a guideline to follow in order to encourage the expected changes in the long term.

This first step should facilitate the digital twins process. The workshop methodology used has considerably accelerated the transformation process; the participants go beyond their primary missions and functions to become real actors who act within a system and can influence the directions taken… which makes it much easier to initiate the process of accepting transformations!

Although they exist only in a virtual sense, digital twins are assets in their own right, and in a very real sense. And that means they have to be managed properly to maintain all their value. Implementing a digital twin without considering the factors that determine its success (corporate governance, which skills to outsource, which to keep in-house, support structures etc.) is to take the risk that its content becomes less and less reliable over time, until it's finally useless."

David SIMPSON,
Asset Management Director

How can we use data and software better, and exploit the collective intelligence of a team without "pushing" the technology or getting bogged down in "toolbox» approaches? That's the question large organizations are now asking themselves. While the digital twin concept does not yet occupy centre stage in this regard, emerging imperatives - extracting more value from data and optimizing its circulation, placing end users at the heart of the debate on digital technology, designing and planning our built environment via a systematic approach (including factors such as operating costs, climate disruption, depletion of planetary resources etc.) - are increasingly positioning it as a natural solution."

Thiziri HAMEG,
Digital Projects Manager

the construction of an infrastructure digital twin demonstrator called Connec(t)win, a solution combining input from IoT (Vossloh), BIM (Catenda), PLM (Eurostep), CMMS (CarlSoftware) and data collection (Ubiplace). Then, in 2023, our teams prototyped their own information routing platform (Twinbox) and demonstrated their ability to interconnect CMMS and LIDAR 3D terrain data on an urban road network (in this case the Brisbane Inner City Bypass in Australia), a solution which reaps the benefits of the digital twin concept without necessarily modelling the assets under consideration.

The common denominator in all these initiatives: cross-disciplinary professional expertise combined with the ability to mobilize developers and integrators: both areas in which Egis has strengthened its hand in recent years as the "logical next step" for its professional knowhow. The Digital Factory created by Egis in 2022 now hosts a digital community comprising some 130 lead developers, business analysts and programmers.

The latest creation of our Digital factory is the GIROS solution, a digital twin commissioned by the port of Bordeaux and developed by Egis in partnership with Oslandia and Fieldbox. In 2023 it won the "City and Territory" trophy in the Digital Twins Awards at the BIM World show in Paris.

Airports and transport infrastructure, stadiums, whole neighbourhoods: in the coming years, the field for modular digital twin solutions like ours is going to expand exponentially!

It takes dedicated teams to keep digital twins relevant

Regardless of all the technology they pack and the sensors that send them information, digital twins lack the autonomy to update or offer 24/7 uptime in full autonomy! In our view, although digital twins will increasingly update their content with machine-generated data (drones, sensors, AI etc.), a considerable degree of human intervention will still be required, especially from construction and maintenance professionals. In today's world, these professionals produce an "as-built" design at the end of each job; in tomorrow's world, they'll offer upgrades to the digital twins which are increasingly used by major infrastructure, development and property managers.

But who will check these models for their compatibility and coherence with data charters, interoperability specifications, safety and confidentiality requirements, or contractors' data dictionaries, independently of construction projects already underway? And who will check that data is circulating correctly between the physical and virtual poles, in cases where maintenance is necessary? Who will make sure digital twins adapt to the new technologies and new standards and regulations that will emerge in the years to come?

In our view, these tasks will fall to "Twin Operators" who draw on their knowledge of data management standards (ISO 19650), BIM/SIG and management / maintenance data to locate and identify potential problems in digital twins.

Our engineers are already mobilizing these skills in our major infrastructure construction projects using BIM and our operation/maintenance

and asset management contracts for roads, airports and public transport networks, and they're eager to apply these same skills to the development of the digital twins of the future!

Strengthened by the experience they've acquired in recent years through their involvement in the digital technology aspects of major infrastructure and operation projects, our engineers are more than ever ready and able to design, structure, develop and deploy digital twins that meet the specific requirements of our clients. And for those who still see the implementation of digital twins as an overly time-consuming process, our microservices and applications provide rapid and effective solutions to concrete issues while preparing the ground for a full-blown digital twin deployment. ■

DID YOU KNOW?

Egis develops focused business applications called "microservices" to optimize the potential of digital twins.

These digital twin microservices include simulation tools and applications serving users/residents:
- **ICEtool**, an application which monitors neighbourhood surface temperatures to quantify the "urban heat island" effect
- **Cenos.ia**, an environmental reporting platform which monitors parameters such as noise and air quality to predict imminent environmental issues such pollution, inconveniences to residents and, coming soon thanks to IA, incidents and abnormal behaviour.

Egis develops and operates this type of application in the service of local administrations. ■

GIROS : MORE THAN A DIGITAL TWIN, AN INNOVATIVE APPROACH, A COLLABORATIVE PROJECT

Egis helped the Grand Port Maritime de Bordeaux (GPMB) to manage and develop the largest estuary in Europe by developing digital models and decision-making tools.

In practice, this estuary is a historical communication route where many activities coexist (tourism, fishing, commercial shipping, culture, etc.). Within its 130,000-hectare catchment area, the GPMB manages the public domain and develops the territory. The port's actions are therefore guided by the need to strike a balance between economic development and environmental protection. For many years, it has been working to improve our knowledge of the river and its estuary through its instrumentation (tide gauge network, current meters), its bathymetric measurement campaigns and the improvement of digital models (GIRONDE XL 3D). However, to go further and make this data available to everyone, the GPMB wanted a digital twin of the river. This was planned, organised and managed by Egis in record time (6 months!) with the help of a very high level scientific and IT community. In addition, in order to ensure that the digital twin could fulfil its function perfectly, Egis invited a very large number of stakeholders (Grand Port Maritime de Bordeaux, representatives of river-related professions, water managers, the water agency and scientists) to participate in this ambitious project. As a result, this forecasting model will become a truly effective tool, accessible to all! ■

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