

Reinvent

ing Infrastructure
and Capital Projects

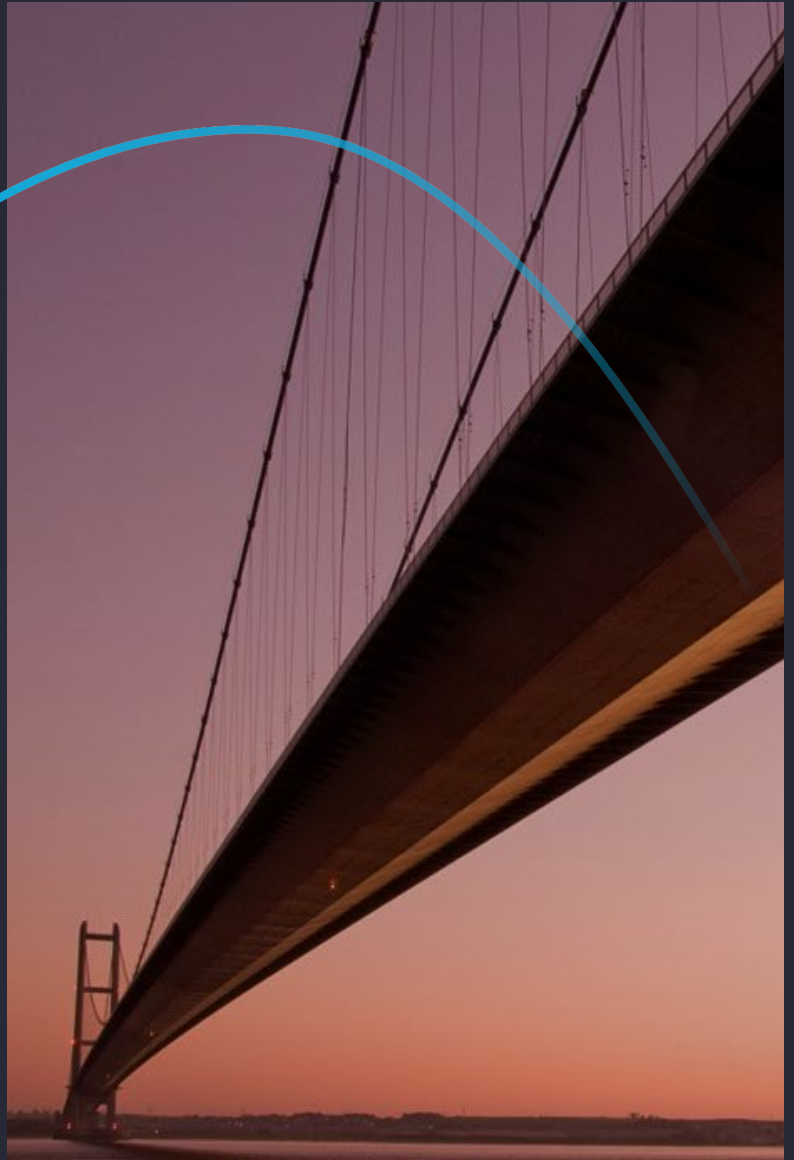




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1 Finding your digital twin in the construction sector

Digital twins. One of those buzz words lately emerged from the **industry 4.0**. Used in so many contexts, and provided with so many different meanings, that making a tangible reality out of it is becoming an increasingly complex challenge for organisations across industries.

Particularly for players in the construction and infrastructure sector, despite the profound, ongoing digital disruption being experienced by the sector, their current lack of clarity around digital twins is hindering them from designing the required strategy to develop, implement and adopt them.

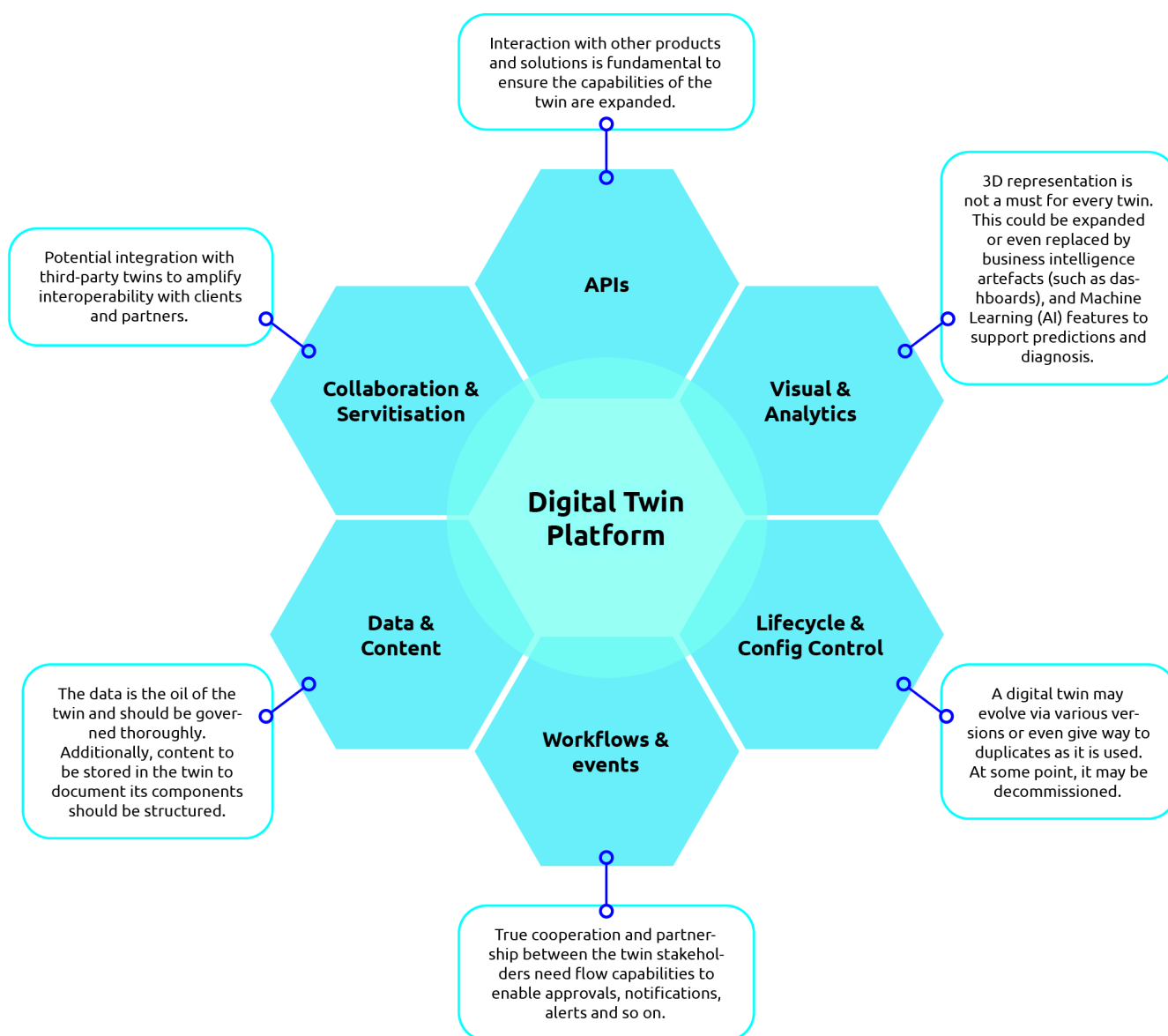
And that is exactly where we, Capgemini Invent, are effectively supporting our clients. Coming back down to earth to help them embrace a pragmatic, sector-specific approach, and truly unleash and realize the wide range of benefits promised by Digital Twins.





1.1 From the beginning

From a canonical point of view, a digital twin can be defined as a digital representation of a real-world entity or system¹. In order to truly serve its purpose, enabling such digital representation and translating it into a source of actionable data to effectively manage the underlying real-world entity, six specific features should be undoubtedly incorporated into any digital twin.



¹ [Gartner, Definition of Digital Twin, IT Glossary](#)



1.2 Make the case for your twin

However, features above don't clarify which specific real-world dimensions should be tracked and embedded into the digital twin. Although purists may argue that it should incorporate all aspects of its underlying physical system or entity, this approach would get the technology away from being pragmatic and realizable, making it extremely complex to understand and to later use it.

Therefore, properly identifying and framing the right dimensions of the twin should be a better approach when it comes to exploiting its benefits from a tangible perspective. But what are such dimensions for Infrastructure players?

Backed by our experience, we highlight three specific layers – **assets, users & enablers** – which could be included into the digital Twin, as having proved to effectively support valuable use cases at the different stages of the infrastructure lifecycle, from construction to operation and maintenance.

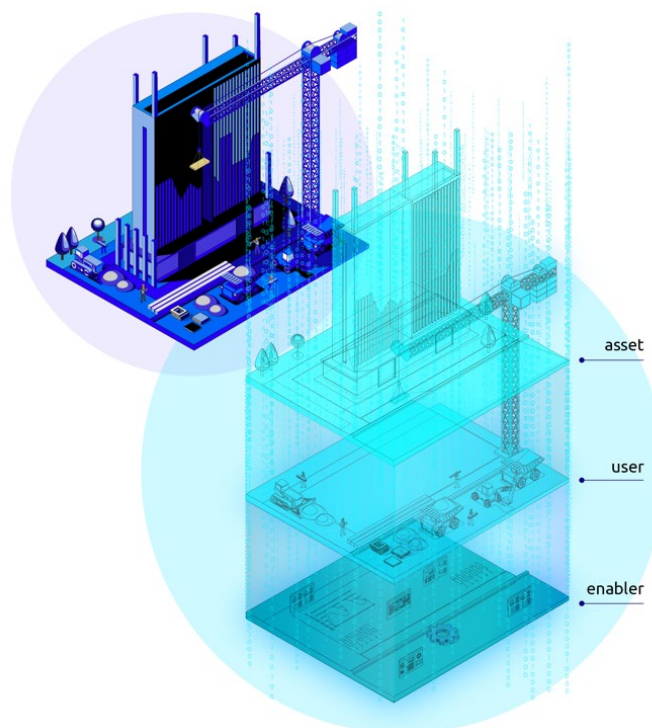
From Capgemini Invent, through our extensive work collaborating with clients to ensure that digital twin deployment and use is translated into practical value for them, and that such value is maximized, we have developed a comprehensive understanding of such use cases, applicable for both contractors and owners & operators. The following table outlines just a few of them.

DT Dimension	For owners & operators OPERATION & MAINTENANCE			For contractors CONSTRUCTION		
	Definition	Case	Benefit	Definition	Case	Benefit
Asset 	Actual infrastructure being operated and maintained. E.g. Assets location, maintenance history, condition, etc.	Straightforward access to correct as-built and as-maintained data regarding an asset.	Reduced costs during maintenance scoping works and increased quality of service.	Actual products being built, including its components. E.g. Materials, Quantities, Progress, etc.	Provide a comprehensive site representation to site supervisors of the as-planned and as-built asset.	Reduced disruption to site works, minimised travel efforts and early hazards identification and regulation compliance.
User 	Physical objects / resources making use of the infrastructure. E.g. Location and quantity of vehicles, distance travelled, etc.	Development of what-if scenarios of infrastructure usage at key locations, based on actual and historical data.	Early warning system to mitigate network issues in advance. Data-driven justification for prioritising improvement schemes.	Machinery / resources on site, working on building the assets E.g. Position, uptime, PPE, etc.	Approval workflow for personnel on site, including associated documentation.	Increased compliance (and reduced HSE penalties) related to work authorisation for personnel.
Enabler (underlying processes) 	Entities upholding the correct functioning of the infrastructure network. Eg. Crew movements, depot critical stock, suppliers availability, etc.	Connection to strategic suppliers and integration with network warehouses stock database.	Reduce lead time for critical materials available to undertake corrective works on the networks.	Underlying supply that feeds the construction site. E.g. Status and location of orders, supply-side stock, etc.	Communication loop with suppliers to track delivery of key components.	Increased visibility of schedule-related risks for critical path activities.

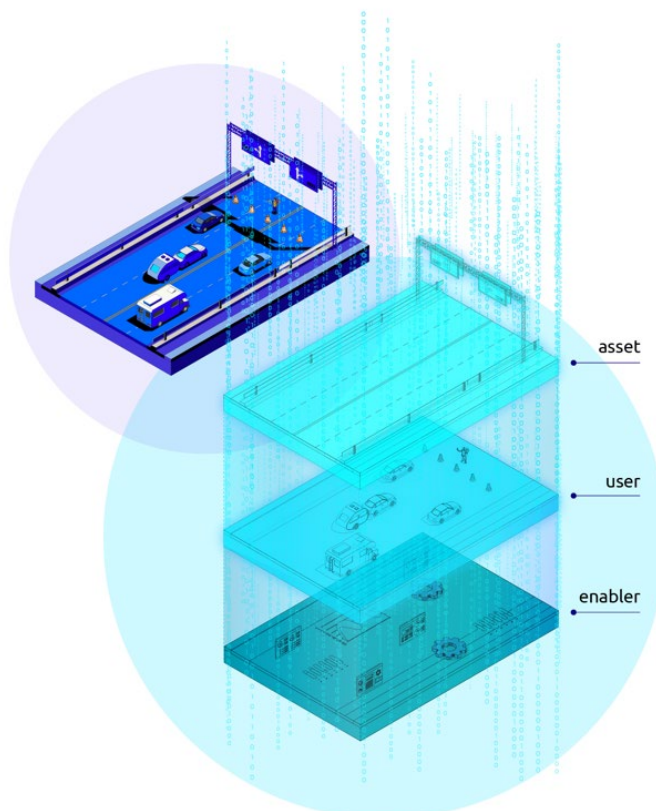


As shown, mapping the Digital Twin use cases with the specific dimension, lifecycle stages and stakeholders impacted can help players within the construction and infrastructure sector clearly frame the benefits to be potentially obtained, and thus ensure that digital twin-related efforts are truly focused on what brings more value to each organization.

Digital twin for the construction phase



Digital twin for the operation & management phase





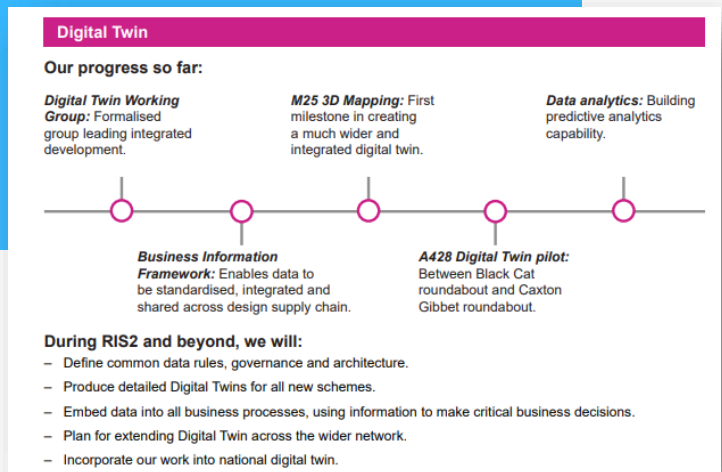
1.3 Digital Twins already on the spotlight

The use cases mentioned above are just some practical examples of how Digital Twins could be valuable for the infrastructure sector. We expect that the “reckoning” of the impact digital twins may have on organisations will take place sooner rather than later, as emerging market forces and trends will challenge existing competitive advantages.

In fact, we are seeing that the use of Digital Twins is being spearheaded by governments - as the greatest consumers of infrastructure and capital projects- which are therefore aiming to apply a “pull” force to the market.

National Highways (UK)

In England, the owner of the major motorways has included Digital Twin as a critical pillar in the next investment period, expecting to contribute to a national twin with the support of its supply chain



Dirección General Carreteras (Spain)

In Spain, the DGC is on a journey to build a digital twin of the national road network, as part of the wider digitalisation strategy.

FIRMADO

MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

SECRETARÍA DE ESTADO DE INFRAESTRUCTURAS, TRANSPORTE Y VIVIENDA
SECRETARÍA GENERAL DE INFRAESTRUCTURAS
DIRECCIÓN GENERAL DE CARRETERAS
DIRECCIÓN TÉCNICA

dirección del presente contrato. La información a suministrar por cada BB.DD / SS.GG y los plazos para la implementación de los protocolos se establecerán de manera consensuada con los gestores de dichas BB.DD / SS.GG.

Al conjunto formado por el modelo digital y las BB.DD / SS.GG existentes y futuras “hablando” un idioma común y compartiendo datos por medio del modelo digital le llamaremos gemelo digital.

Asimismo, es fundamental para el éxito de esta nueva forma de trabajar, compartiendo datos a partir de los cuales se construyen sistemas de gestión que permiten tomar decisiones y predecir situaciones, que los datos sean absolutamente fiables.




Este contrato es el primero de una serie que tendrán por objeto la construcción del modelo digital de las carreteras en servicio; dentro del mismo se deberá proponer y construir un primer borrador de modelo digital totalmente operativo que sirva para testarlo y mejorarlo hasta validarlo. En este contrato se colaborará en la redacción de los pliegos de los siguientes contratos y se establecerán los criterios y prescripciones para el establecimiento de un idioma común en todos los trabajos relacionados con los sistemas de gestión de la información de la DGC.

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1.4 Start your twinning journey

The evolution of Digital Twins will thus force the development of new capabilities across the infrastructures supply chain to catch up with new requirements. While the level of capability required will significantly vary from organisation to organisation, depending on their position within the chain and their business proposition, we expect most -if not all- of them in the industry to fall in one of the buckets in below:

	 Builders	 Adopters	 Observers
Role	Those who are going to develop the digital twins and all their capabilities.	Those who are going to make significant use of a digital twin.	Those who should know what a digital twin is but will interact with them in a light or very occasional way.
Involvement	<ul style="list-style-type: none">• Actively involved in developing the solutions.• Requiring a deep and wide business and technical knowledge of digital twins.	<ul style="list-style-type: none">• Involved in interacting with the solutions.• Requiring a strong understanding of the use of digital twin and high-level capabilities to operate with them.	<ul style="list-style-type: none">• Directly or indirectly impacted by the solutions.• Requiring an awareness of the use and purpose of digital twins to interact with the stakeholders.
Examples	<i>Tech companies and/or advanced digital hubs within contractors and operators.</i>	<i>Construction management team to see the operation of its machinery in real time; or operators to consult the elements of the infrastructure or the vehicles in real time.</i>	<i>Management layers, citizens groups...</i>





But deciding the positioning across the spectrum will be only the first step to take by actors within the infrastructure industry. In order to truly jump on the opportunity and capitalize on its full related value, organizations across the sector should follow a structured approach to their digital twin journeys. Listed below are the six steps that we encourage our clients to consider:

1 **Understand your organisation's position in the spectrum**
Builders, adopters and observers will have different requirements in the digital twin journey. Identify where your organisation aligns the most based on your strategy, client needs and so on.

2 **Collect use cases for your twin**
Using a group of relevant stakeholders, collect a long list of use cases, then structure and prioritise them. A thought-through landscape of uses for the twin will be the backbone for building your assets and capabilities in a strategic way.

3 **Develop your digital twin framework**
Developing and/or acquiring the technology artefacts behind your twin is just one part of the equation (for Builders and Adopters). To ensure the adoption is a success, you need to outline the roles, culture and processes that will govern the use of the twin.

4 **Prepare your workforce**
The potential of a technology is as good as the ability of its customers to understand it. In parallel to developing your digital twin framework, start your change management activities, including awareness-building, communication and training tasks.

5 **Start piloting**
Using your priority cases, select the parts in your organisation where they could yield the greatest benefit. Test the framework in parallel to your current ways of working to flag the gains as well as refining it. This should help you enhance your implementation approach.

6 **Wider deployment**
Having honed your digital twin framework and understanding the better way to deploy it, go wider and deeper in your organisation in waves.



1.5 How Capgemini can help

We have worked with many organisations in discovering, testing, deploying and supporting emerging and disruptive technologies throughout the last decades..

Among our capabilities, Reflect IoD is a cloud-based and secure Digital Twin Platform that enables data-centric collaboration for building and infrastructure operations and maintenance.

It is the only platform integrating natively 1D to 3D, Geographical Information and IoT data, therefore managing the asset's Internet of Dimensions (IoD) along its lifecycle.



Whether you need support in introducing digital twins in your operations, a horizon-scanning capability to identify digital twin use cases or building a digital twin platform from scratch, we have you covered.

Innovation, Strategy & Design



Our colleagues at frog excel in discovering the impact of emerging technologies, as Digital Twins, on the transformation of leading organisations, defining your vision on how to address this technology or in setting-up your long-term adoption strategy.

Digital Operating Model and Change



Our management consulting arm is a leader in developing your digital strategy, defining your Digital Twin framework, adapting your operating model and managing your change journey.

Build and Deploy



Our technology experts are strongly positioned to develop and test the digital twin assets required for your operations, as well as support you during the implementation phase.



If you would like to find out more, contact our experts:

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Capgemini Invent is an integral part of Capgemini, a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 325,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering, and platforms. The Group reported in 2021 global revenues of €18 billion.

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