The National Digital Twin

An ecosystem of connected digital twins enabling better decisions faster across the built environment
Aligned government messages
Data for the public good

Recommendations:

1. **A National Digital Twin** – to enable better outcomes from our built environment

2. **An Information Management Framework** – to enable secure data sharing and effective information management

3. **A Digital Framework Task Group** – to provide coordination of key players
Progress

Gemini Principles

Roadmap

DT Hub

The CDBB is establishing the Digital Twin Hub (DT Hub), a collaborative web-enabled community for those who own, or who are developing, digital twins within the built environment.

The DT Hub will give members a safe space where they can learn from, and share with, others who are on the same journey. Members will be able to participate in events that will not only develop their own capabilities, but also advance the state of the art in digital twins.

The DT Hub will be steered by a group of experts from the academia, government and industry and it will be chaired by Sam Chorlton, director for Digital at

Blog: Samuel Chorlton, Chair of the Steering Group - sets out some of the challenges and opportunities.
# Gemini Principles

**The Gemini Principles**

- **Purpose:** Must have clear purpose
- **Public good:** Must be used to deliver genuine public benefit in perpetuity
- **Value creation:** Must enable value creation and performance improvement
- **Insight:** Must provide determinable insight into the built environment
- **Trust:** Must be trustworthy
- **Security:** Must enable security and be secure itself
- **Openness:** Must be as open as possible
- **Quality:** Must be built on data of an appropriate quality
- **Function:** Must function effectively
- **Federation:** Must be based on a standard connective environment
- **Curation:** Must have clear ownership, governance and regulation
- **Evolution:** Must be able to adapt as technology and society evolve
Digital twins

Physical Twin

Data

Interventions

Decisions

Outcomes

Insights
Connected digital twins
Ecosystem of connected digital twins
Ecosystem of connected digital twins
Benefits of the National Digital Twin

Better outcomes for the public per whole-life pound

- **Benefits to society:** Improved stakeholder engagement. Better outcomes for the ultimate customers (the public – taxpayers/bill payers/fare payers/voters). Improved customer satisfaction and experience through higher-performing infrastructure and the services it provides.

- **Benefits to the economy:** Improved national productivity from higher-performing and resilient infrastructure operating as a system. Improved measurement of outcomes. Better outcomes per whole-life pound. Improved information security and thereby personnel, physical and cyber security.

- **Benefits to business:** New markets, new services, new business models, new entrants. Improved business efficiency from higher-performing infrastructure. Improved delivery efficiency, benefiting the whole construction value chain – investors, owners, asset managers, contractors, consultants, suppliers. Reduced uncertainty and better risk management.

- **Benefits to the environment:** Less disruption and waste. More reuse and greater resource efficiency – a key enabler of the circular economy in the built environment.
Reimagining infrastructure...

...as a system of systems
...as a system of services
...as a cyber-physical system
...as a sustainable system
Infrastructure as a system of systems
Infrastructure as a system of services

Infrastructure

Outcomes

Eudaimonia = Human flourishing

Services

Social

Economic

Environmental

Human flourishing
Infrastructure as a cyber physical system
Infrastructure as a sustainable system
The information value chain

Decision taking

Sense making

Data management

DLT

AR/VR

AI/ML

Big Data

IoT

Learning

Insights
Connectable digital twins

Physical Twin

Digital Twin

Data

Interventions

Decisions

Outcomes

Insights
Digital twin interfaces

Mental

Physical

Digital
The Information Management Framework

• The Framework includes all the building blocks that are necessary to enable effective information management across the built environment.
• It is a coherent structure within which the key building blocks (governance, standards, enablers etc) logically fit
• At its heart, is the Commons – a national resource that provides the necessary standards to enable effective information management and secure, resilient data sharing

The Framework enables:
• the CDBB vision
• effective information management – “putting the right information in the right hands at the right time to make the right decision”
• secure, resilient data sharing between organisations and across sectors
• the National Digital Twin – an ecosystem of connected twins
• better decisions, based on better data, leading to better outcomes per whole-life pound
The background to the approach

Top down (Authoritarian)

Bottom up (Darwinian)
The emerging approach

**Commons**

A national resource, held in common, that unlocks effective information management across the industry; the minimum necessary open standards/methodologies; expert led – the “ministry of all the talents”

**DT Hub**

Collaborative, web-enabled, learning community that learns by doing; captures and shares emerging best practice; turns experience into guidance and guidance into standards; practitioner led – those who own or are developing digital twins.
The objectives of the DT Hub

- Learning and sharing experience
- Showcasing the benefits and creating case studies
- Capturing good practice and developing guidance
- Innovating and advancing the state of the art
- Creating a support network
- Providing a register of key work on digital twins
- Enabling pilots to fill the gaps
- Promoting the adoption of the Gemini Principles and IMF
- Enabling the National Digital Twin
Progress

- National reference data library
- Foundation data model
- Integration architectures

- Steering Group
- Curator
- Founder members
The core streams of the Roadmap

- Approach
- Governance
- Commons
- DT Hub
- Enablers
- Change
## The core streams of the Roadmap

<table>
<thead>
<tr>
<th>Stream</th>
<th>Description</th>
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<tbody>
<tr>
<td>Approach</td>
<td>To define the overall approach for delivering the Framework and to establish the strategies for each of the other streams</td>
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<tr>
<td>Governance</td>
<td>To establish the structures, processes and metrics for managing the development, adoption and ongoing oversight of the Framework</td>
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<tr>
<td>Commons</td>
<td>To develop and make available the necessary support for effective information management via guidance, specifications and standards</td>
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<tr>
<td>DT Hub</td>
<td>To bring together those who own or who are developing digital twins; to identify and share emerging best practice</td>
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<td>Enablers</td>
<td>To identify and address the relevant potential blockers</td>
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<tr>
<td>Change</td>
<td>To facilitate adoption of the Framework across the whole ecosystem of the built environment, in each sector and place</td>
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<td>Category</td>
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<tr>
<td>Approach</td>
<td>Coordination and alignment, not control; guided evolution</td>
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<tr>
<td>Governance</td>
<td>Existing structures where appropriate; three key phases; sector view</td>
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<tr>
<td>Commons</td>
<td>‘minimum viable’ approach; national-level resource</td>
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<tr>
<td>DT Hub</td>
<td>The ‘forge’ for developing/testing/sharing best practice</td>
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<td>Enablers</td>
<td>Prioritised and proactive; not solving everything</td>
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<tr>
<td>Change</td>
<td>Focussed effort on the early adopters and early majority</td>
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Thank you
Outline logic model

Activities
Actions in each stream of the Roadmap

Performance
Performance of infrastructure as a system and as a service

Outcomes
Economic, social and environmental outcomes for people of the UK
Governance

Policy

Implementation

Ultimate customers
Governance

Policy

ICG ➔ CDBB DFTG ➔ BCG ➔ Supply chain

Ultimate customers

Definers
Requesters
Doers
Governance

ICG

NIC - HMT - IPA - DfT - DCMS - BEIS - Cabinet Office - OGP - MHCLG

CDBB DFTG

BCG

Ultimate customers

Supply chain
Governance

Supply chain

Ultimate customers
 Governance

The Commons

Enablers

Change

BEIS

CDBB

DFTG

Rail

Energy

Water

ICG

1

2

3

BCG
Digital twin categorisation

How best to define the work on digital twins so that others can easily understand it?

• Position within the matrix map (lifecycle vs scale)
• Relationship to the purposes that the DTWG has defined
• Owners/key players
• Success criteria
Matrix mapping for DTs

Lifecycle

Scale
## Matrix mapping for DTs

<table>
<thead>
<tr>
<th></th>
<th>Use</th>
<th>Operation</th>
<th>Maintenance</th>
<th>Planning</th>
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<th>Delivery</th>
<th>Re-use</th>
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