

The role of data in decarbonising the delivery and management of infrastructure assets

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The role of data in decarbonising the delivery and management of infrastructure assets

- Using better data, and using data better
- The role of digital twins in decision making
- Deciding WHAT we need to design and build
- Deciding HOW we should build
- With WHICH materials and approaches
- Why taking a WHOLE-LIFE perspective is critical

Using better data

SOCIAL MEDIA AND OTHER DATA

- Geo-tagged social media data for assessing use of infrastructure and sentiment mapping
- Ticketing information
- Mobile phone GPS, wifi
- On-vehicle GPS, vehicle mounted sensors

REMOTE SENSING

- Use of satellite data to monitor large-scale structural and ground movement
- Drone surveys
- Vehicle mounted sensors
- Laser scanning
- Photogrammetry

ATTACHED & EMBEDDED SENSING SYSTEMS

- Autonomous, low-cost and low-power wireless sensing technology for long-term monitoring
- Fibre optic strain sensors
- Combined strain and displacement wireless sensors
- Temperature, tilt, etc



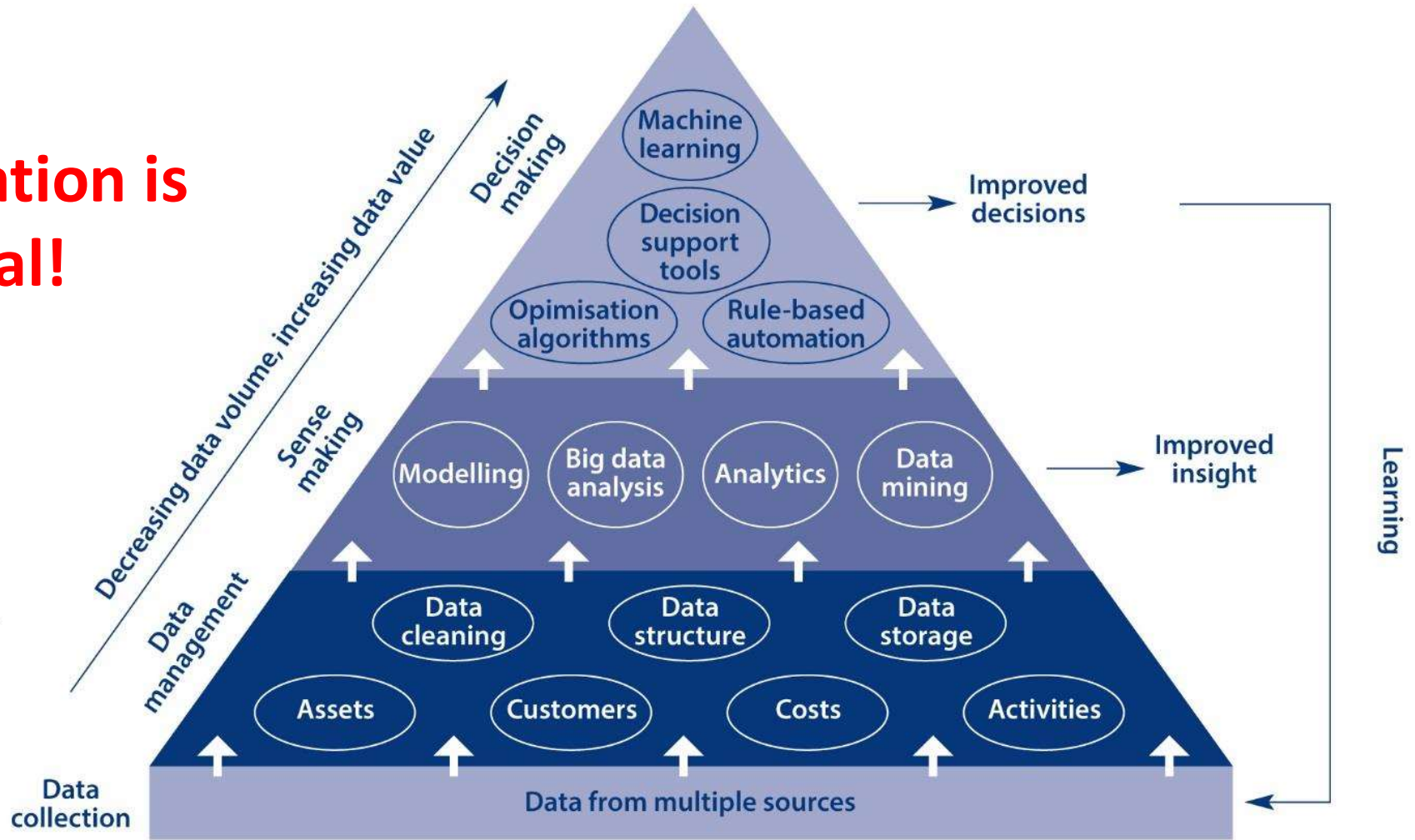
MATERIAL FLOWS AND PROCESS DATA

- Tagging (RFID and similar)
- Time and motion studies – using CV
- Traffic monitoring and management
-

There are many sources of data 010101010

Using better data, and using data better

Data curation is crucial!



Using better data, and using data better

Design

- Calibrating & validating models
- Design for whole life value
- Optimising material use in design
- Accurate assessment of carbon in design

Construction

- Materials management
- Construction progress & quality monitoring
- Reducing waste
- Improving quality
- Improving delivery

Ops & Maintenance

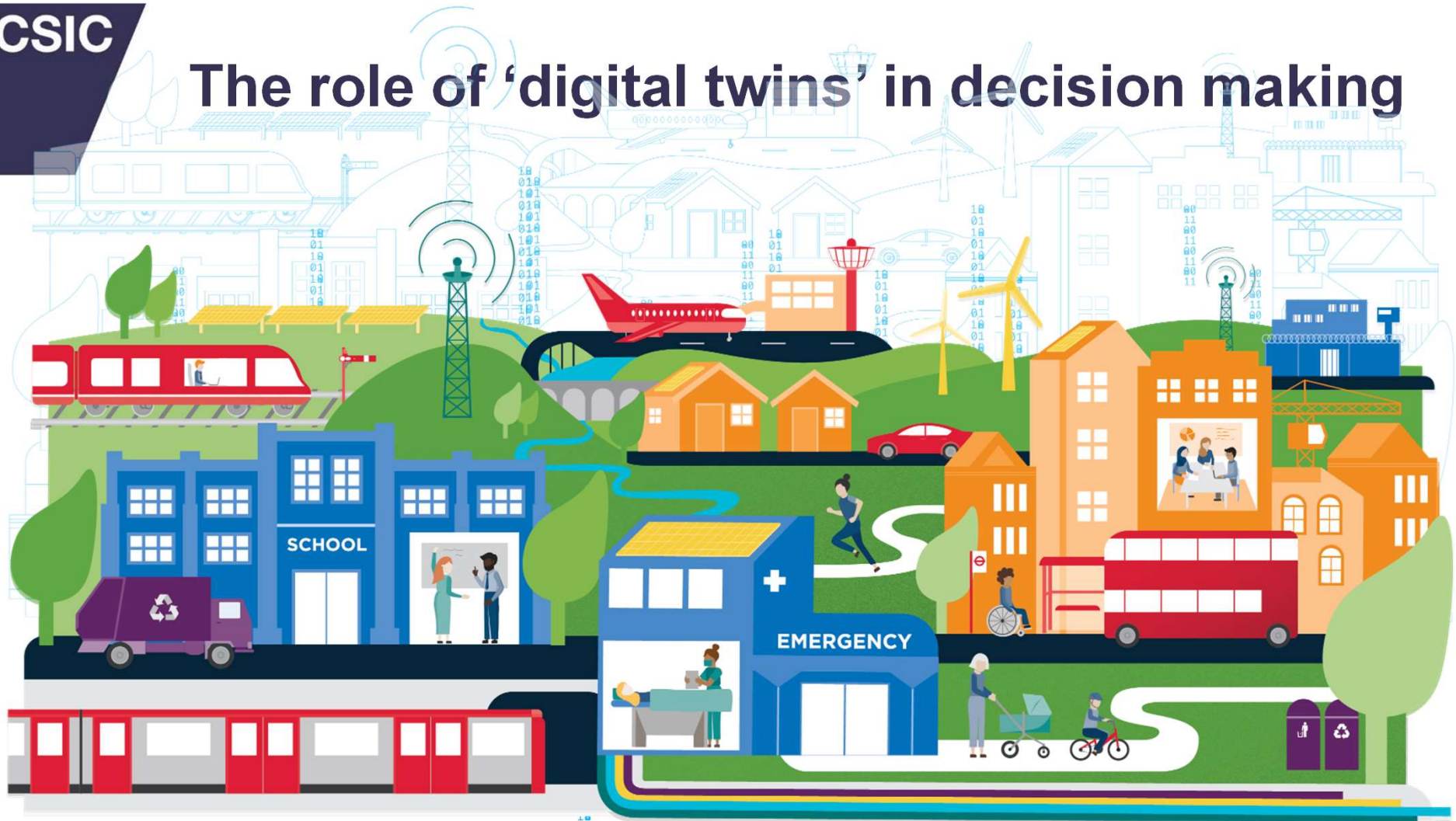
- Condition monitoring and prediction
- Risk-based maintenance
- Futureproofing
- Whole-life, value based asset management

Smart City Systems

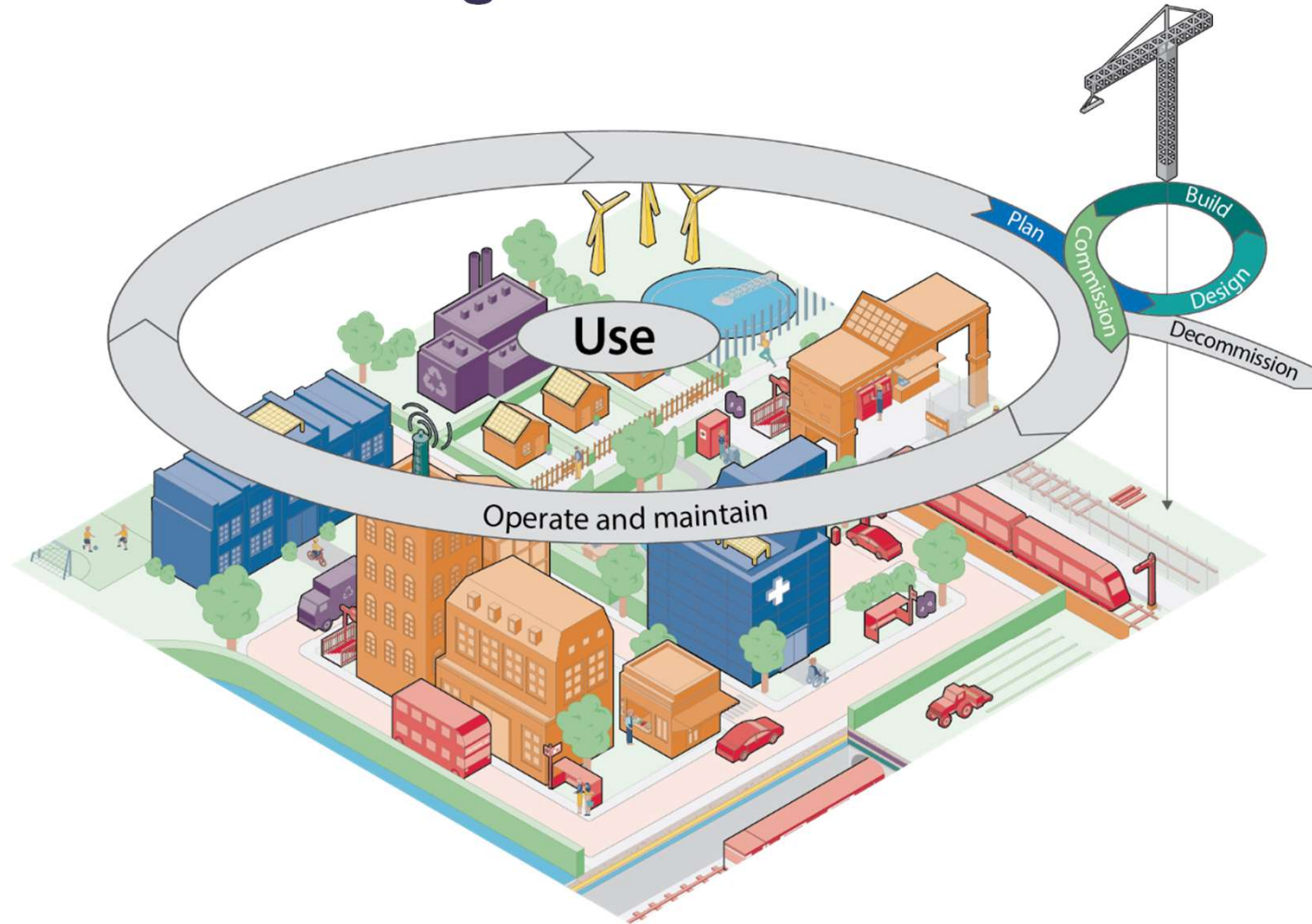
- Demand forecasting
- Optimising network use & management
- City-scale digital twins
- Meeting infrastructure needs

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The role of 'digital twins' in decision making



The role of 'digital twins' in decision making



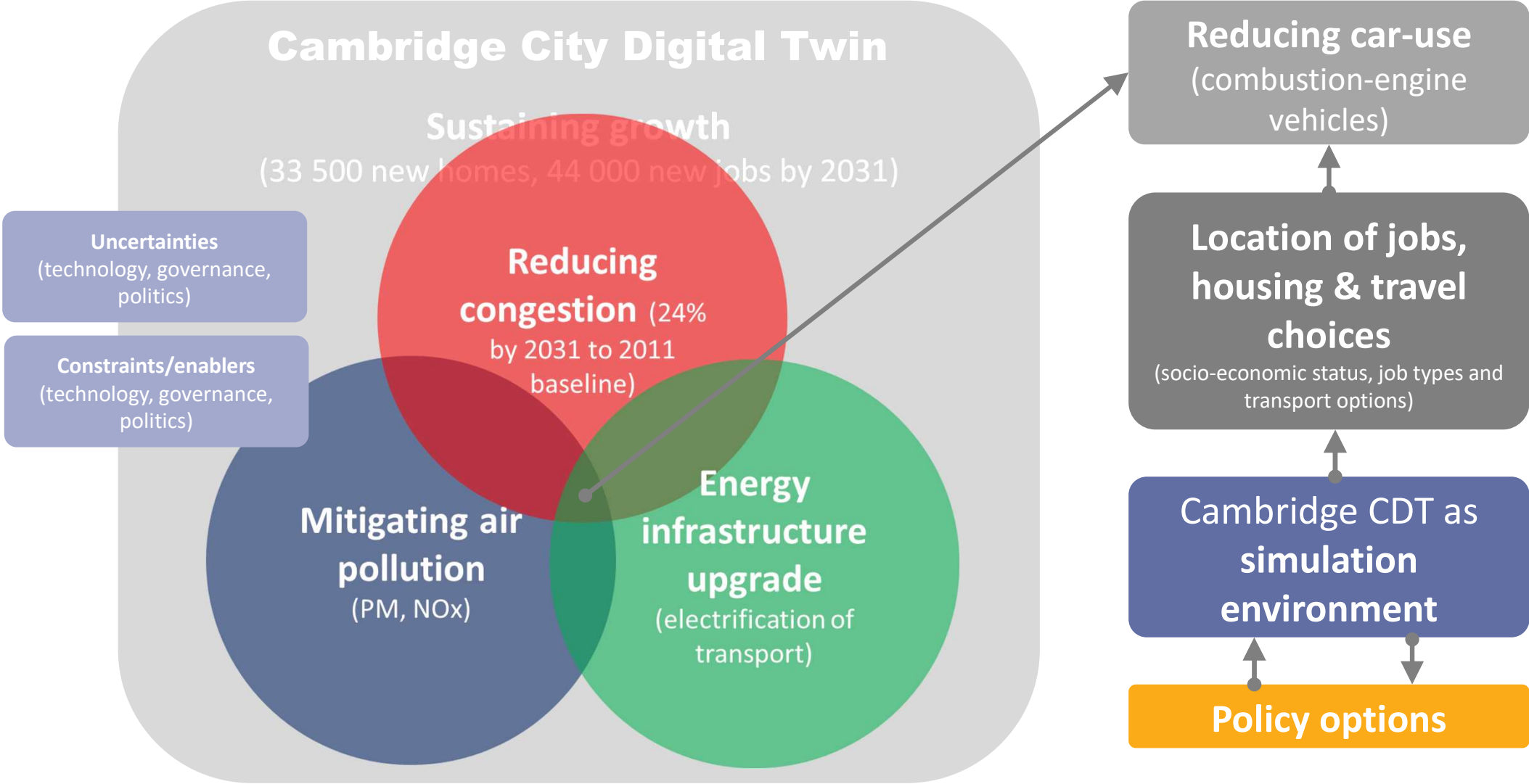
The role of 'digital twins' in decision making



The role of 'digital twins' in decision making

- Utility – Data management, data analysis, data presentation
- Uses – e.g.
- Optioneering – e.g. DC2 Cambridge City DT
- Evaluation and measurement – e.g. how much material is in a given design, how is that reflected in what and how we build it, etc.
- Operational management of a system – e.g. active traffic management

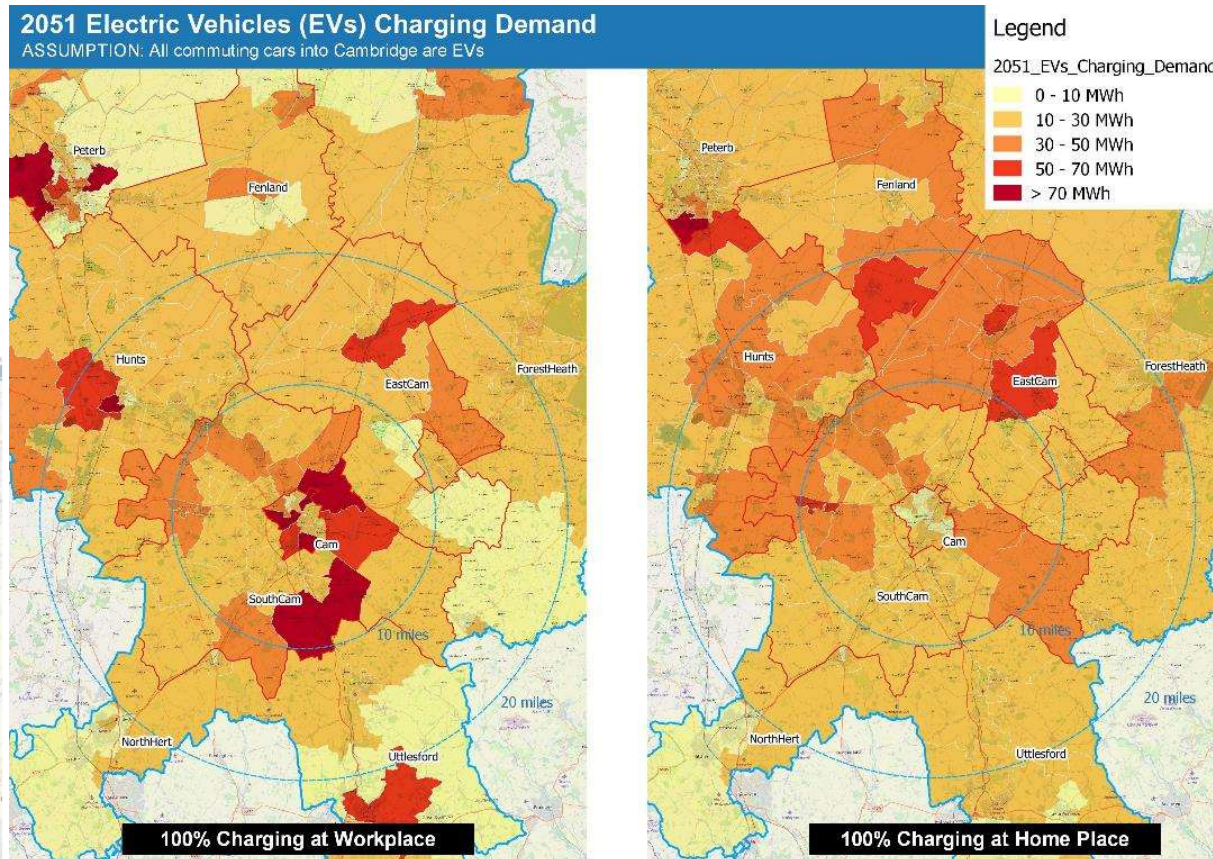
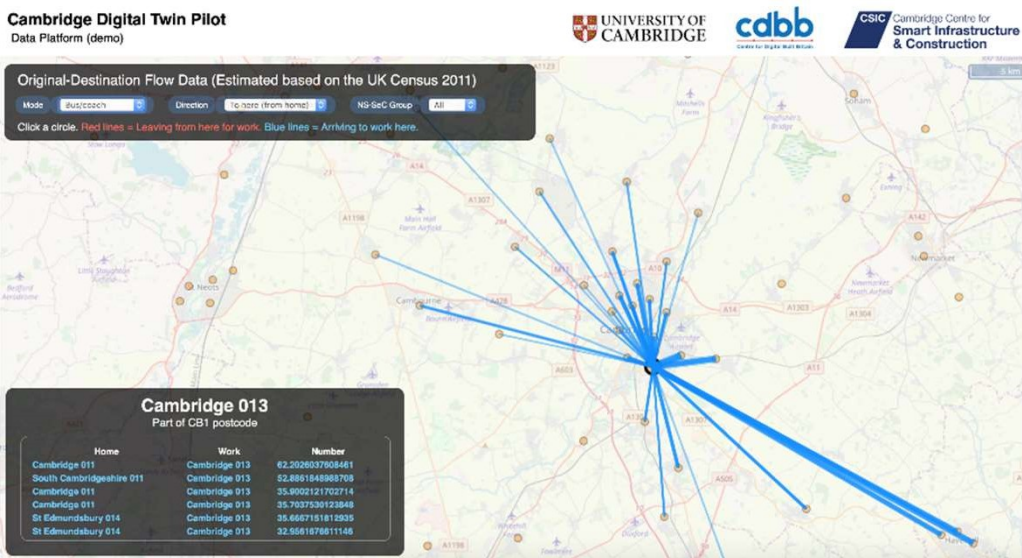
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The role of 'digital twins' in decision making

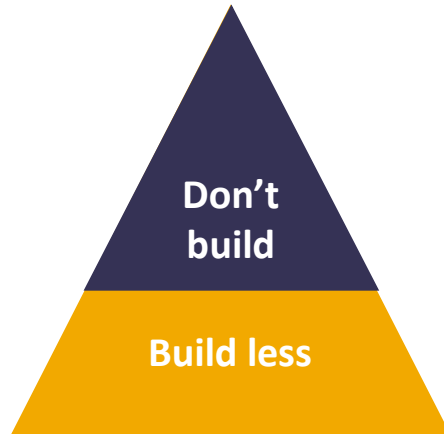
- A unique data set on journeys to work for the Cambridge sub-region
- A computational model that simulates distinct scenarios of travel mode choices





Deciding **WHAT** we need to build

- Indeed, deciding **WHETHER** we need to build at all...

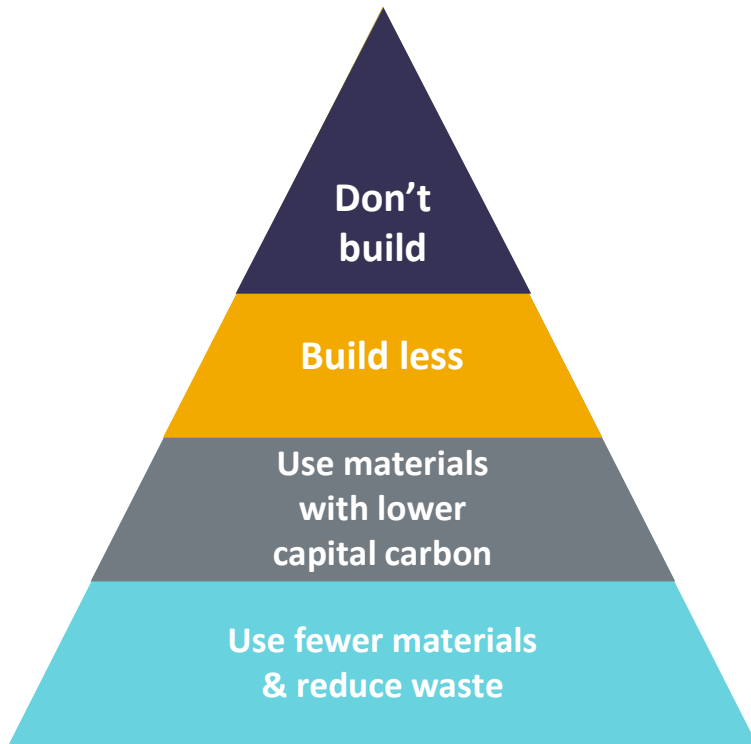


Do we need to build – or is there another solution?

Do we need to build as much?

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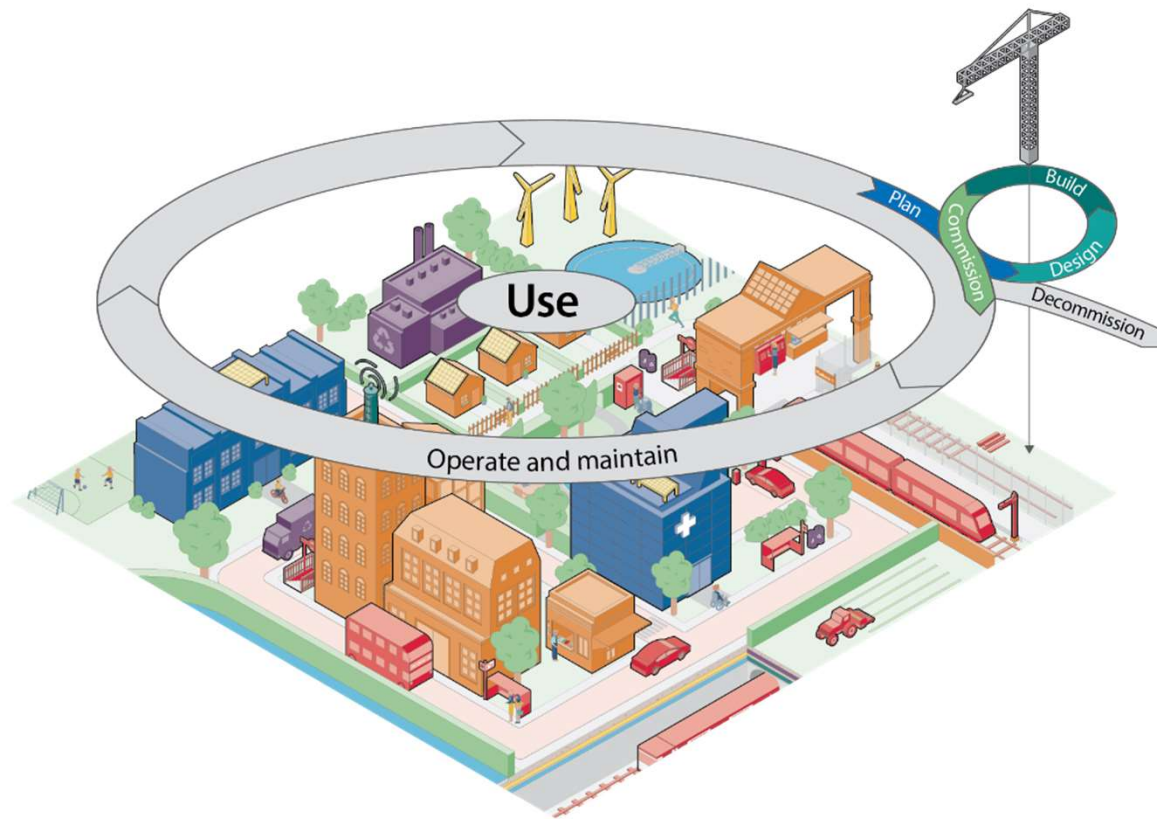
Deciding HOW we should build, with WHICH materials and approaches



What should we build with?

Can we optimise the design, and reduce construction waste?

Taking a WHOLE LIFE perspective



How long will this asset be used for?

Will creating more embodied carbon save carbon over the lifecycle?

How can we make its use more energy efficient?

How can we make it easier to maintain?

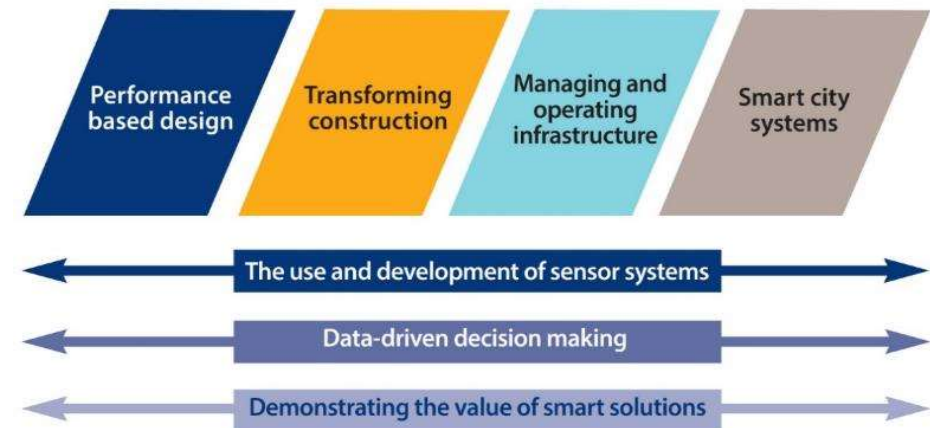
The importance of MEASURING

“If you do not measure it, you cannot improve it”

Lord Kelvin, 3 May 1883

Learning from real performance:

- **CALCULATE AND OPTIMISE** carbon in the design
- **CALIBRATE** design models against real performance
- **CONTROL** processes on construction sites
- **USE** standards, e.g. PAS2080
- **MONITOR AND MANAGE** waste in construction
- **ASSESS AND DECLARE** actual embodied carbon
- **MEASURE, MONITOR AND REDUCE** carbon fuel use
- **INVEST** in innovation to improve – and **MEASURE AGAIN**





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Smart Infrastructure – the benefits

CSIC aims to transform the engineering science and change the way the industry operates through

- understanding real performance
- reducing uncertainty in design, condition assessment, construction and asset management
- optimising the value of asset management and operation
- creating smart infrastructure solutions for smarter, resilient cities
- revolutionising practice



Thank you for listening

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