Decarbonisation of Transportation Networks using Digital Twins

Hard to Decarbonise Technologies Special Interest Group

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Panel

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Challenges

- Transport represents a quarter of UK's CO2 emissions and is hard to decarbonise.
- A plethora of transport decarbonisation policy strategies already in different urban environments. A useful summary can be found in the recent report of the Independent Transport Commission.
- Several avoid/shift/improve strategies to reduce land transport emissions, but only selective implementation so far; issues include funding, differential and controversial socio-economic impact.

Challenges

- Digital twins represent a chance to harvest data to help direct policy efforts for transport decarbonisation. Challenges for their use include concern over data ownership and trustworthiness, users' privacy and ethical management.
- Carbon reduction is going in the right direction, but total traffic demand is still rising. This trend calls for a coordinated effort to benchmark policies that work, collecting relevant data, and scaling up successful interventions
- Projections are optimistic, but a question emerges: are we intervening fast enough? What strategies can be deployed to reliably reach a trend inflection point? The reactions to deployed strategies are not linear, this is where digital twins could provide support in measuring and anticipating response.
- All organizations have the potential to provide relevant data through the collection of information on employees' micro-mobility, or the installation of smart sensors in buildings, parking facilities and freight vehicles, collecting live measurements.
- It is crucial to reflect on how travel information can be used to understand travel behaviour: transport decarbonisation is not only a "transport" issue, but requires the wider comprehension of how activities generate travel demand.
- People' lifestyles have been proven to be very stable, even during the pandemic. To achieve decarbonisation, first we need to understand these patterns and target interventions to key groups. For instance, what would be the differential impact of subsidizing private electric vehicles' purchasing/charging? How could we address the rural-urban divide?
- Digital twins are not a generic technology, but tools that could help us in creating doubles not only of the built environment, but also of human behaviour to better understand it.
- The built environment should be considered as the sum of social infrastructure and natural environment, a system of systems with different layers of information
- Machine learning is now beginning to provide ways to classify large quantities of built environment data. While still requiring interpretation, these tools are strategic instruments for tackling the challenge of creating city-wide digital twins.

Opportunities

- Public and private dialogue allows us to develop frameworks of study and intervention, thinking outside the box. One such example is the collaboration between the London Transport Museum and the global consultancy Mott MacDonald
- Digital twins represent a clear opportunity to achieve value creation. A comprehensive framework of analysis is contained by the work of the Centre for Digital Built Britain
- A "system of systems" approach can guide the creation of a National Digital Twin, an ecosystem of connected digital twins, particularly to address the challenges affecting climate resilience
- There is the potential to integrate datasets from across different sources to create real-time feeds of transport behaviour. For this data framework to be achieved, we must reflect on how to solve data ownership and sharing constraints.