

Questions raised during the Pathway towards an IMF Webinar on 8 June 2020

1. Does the panel have any thought about the "development platform" envisaged for the prototype? e.g. FC? XML? Relational database? Spreadsheet?
2. Who will be responsible [for] handling the information that is stored in the national digital twin?
3. How will the organisations and people be motivated to contribute as needed to the digital twin?
4. Data structures vary from asset to asset, in terms of quality, quantity, meaning etc. how are these differences going to be dealt with? And who will manage this process?
5. I am currently working with BSI, CEN and BuildingSMART on the development of IFC, including information exchange. How does IFC fit into the framework? I recognise that IFC will not describe all aspects of the digital twin, but it should at least form a cornerstone of the framework.
6. The Gemini principles reference openness, and the IMF Pathway talks about the need to have a foundation data model and a reference data library. As much of this is covered (at least in part) by IFC, what is the intended relationship between the NDT/BuildingSMART/IFC (ISO 16739-1)?
7. How many of Digital Twins hub are SMEs? As, to me, engaging SME is vital in all of this.
8. John Muir once said: "When we try to pick out anything by itself, we find it hitched to everything else in the universe." Apart from authorization and security, or in other words, assuming a user with a query is granted a full access to the NDT, whether via a 'Query Engine' or a 'Discovery Protocol', a flawless NDT will actually keep capturing the interdependencies of all DTs until the whole NDT is found to be relevant to the user's query. Is that what we ultimately aim for, or is there some kind of a boundary or a threshold that shall be imposed to limit the result into a more practical and meaningful one?
9. How will you manage the competing and possibly conflicting priorities across the sector and ensure a cohesive approach to digital twins?
10. We're currently working on a European H2020 project on Digital Twins where we implement an ontology based on the ISO 15926. Can we align visions with CDBB?
11. Will the proposed distributed ecosystem be able to make better decisions than its human counterparts, autonomously?
12. IFC is way too complex at the moment to serve as standard for data transactions. how would you like to tackle that? Data and geometry should be separated at least, imo. What is the vision of CDBB?
13. What will delegate the way that the data from projects or individual assets can be developed in a streamlined fashion to make the integration of data simpler? How will this be translated into changes in organisations and how they create or manage information? (How will these changes be translated into organisational changes and how will they be motivated to do it?)
14. Discussions to date seem focused on representing the built environment - the 'supply side'. Some high value areas for NDT will be bringing it to life by adding humans and their behaviours - the 'demand side'. Is this a key part of the IMF and what are the any emerging plans? Any views on forecasting demand v supply?
15. As the 'corpus' and whole NDT grows, it is expected to receive more complex answers and results in response to our cross-sector questions, to an extent that answers may become too intricate to

justify or interpret their causalities. Are we willing to stay on top of the NDT or shall we expect the NDT to eventually takeover, by throwing answers at us that may not make sense and beyond scrutiny?

16. How engaged are the local authorities with the concept of digital twins?
17. I understand the current plan to catalyse consensus through discussion. However, in parallel, others in silos press on with solutions to the same problem. How are we going to ensure that all the current players are involved in the process? The document does not reference many relevant initiatives including the Open Connectivity Foundation's latest IP-BLis partnership and many others such as the Digital Twin Consortium and OneM2M?
18. We all understand the importance and theory, but we need some practical first steps that we can work with and a standardised approach with a clear direction. So, if we want to start building our digital twins today - what should we be doing?
19. Materials in the CDBB/DFTG reports often concentrate on approaches to data sharing, and model sharing is also an important part of the DT agenda. Can the panel comment please on the current state of play in thoughts on how models will be shared - whether that be computer codes or specifications of models on paper - and how these models might be linked together?
20. [Are] the data sources etc being designed with version control in mind, so the past and the correct history and context be determined?
21. Materials in the CDBB/DFTG reports often concentrate on approaches to data sharing, and model sharing is also an important part of the DT agenda. Can the panel comment please on the current state of play in thoughts on how models will be shared - whether that be computer codes or specifications of models on paper - and how these models might be linked together.
22. Neil Thompspon often compares the commons and the IMF to the internet. Would Wendy agree that this work to form a national digital twin (internet of assets?) is analogous?
23. I'm concerned they're are far too few 'experts' on this journey. Is there a sufficient population of knowledgeable people across the UK, breadth and depth to make this work? I'm not sure enough is being invested in people skills.
24. I totally agree about the need and benefits of a national infrastructure digital twin. A large proportion of these are government owned at a central or local level, however apart from mega projects, very few clients mandate a BIM as part of procuring their works and services. Is this not a crucial first step?
25. The benefits of the NDT to the country is really clear but could the panel set out the real selling point to individual companies who will have to make some potentially significant investments to align what they are doing now?
26. How do you see the UK BIM Framework and IMF working together? Or will the IMF supersede the UK BIM Framework eventually?
27. Is the work of CDBB linked with the Geospatial Commission?
28. How has the Government reacted to this report - does the panel think that there is the stomach for mandating the NDT approach, at least for government spending?
29. I totally agree about the need and benefits of a national infrastructure digital twin. A large proportion of these are government owned at a central or local level, however apart from mega projects, very few clients mandate a BIM as part of procuring their works and services. Is this not a crucial first ste?

30. How do we ensure that a 'security minded' approach is adopted to avoid leaking data/IP that creates unacceptable risks?
31. Is this plugged into the work being taken forward by CLC for the recovery plan and how much connectivity does the team have with the Building Safety Team at MHCLG e.g. with Golden Thread, IRG etc?
32. I detect some ambiguity in section 3.6 on the Reference Data Library. On the one hand it provides the controlled vocabularies that confer meaning on specific terms, so therefore it will look like a set of conceptual models that identify and name concepts, their characteristics, persistent associations and behaviours. (?) But on the other hand, it contains data which asserts facts about "particular things, such as where a building is, the ownership of an asset etc" So I'm puzzled by this apparent conflation of a model with its instantiation by data. What have I misunderstood?
33. How does the panel envisage the system of capabilities and competence of those that design, deliver, operate, sustain, utilise, etc. the NDT and DTs being incorporated with the systems of systems?
34. Is the NDT expected to provide an evidence framework for government spending and Treasury Green Book appraisal?
35. There are UK start-ups working on very brilliant and interesting solutions which supports the use of digital twins and data integration within various industry sectors, also combining the implementation of the ISO 15926 standards. How can these start-ups connect and work with the CDBB and DTH?
36. Will the IMF be examining, mapping to, and maintaining mappings of, industry standards, schemas and taxonomies (eg. IFC, UNICLASS, CoClass, RailTopoModel etc), and if so, is the scope of which will be looked at initially known at this point?
37. Will the existence of the twins be shared in a dictionary of twins. Potentially hosted by the CDBB?
38. Will there be an FAQ document published after the webinar today? There are some tremendous questions in there which would be good to respond in a consistent way.
39. Is the NDT expected to provide an evidence framework for government spending and Treasury Green Book appraisal?
40. Who will be governing the compliance when delivering single projects?
41. Not a question as such, maybe connections, partnerships or workshops between the Catapult Networks- Catapult and local enterprise partnerships with the DTH could help with further developments of the pathway. The LEPs work with Local authorities.
42. In relation to skills, are there some specific references / learning / curricula that the panel recommend for people wanting to progress in this area?
43. A lot is said about integrating data and information - but less is said about integrating the knowledge framework that underpins and facilitates the industry as a whole.
44. Does the Digital Twin include those that work in the industry and their competencies? These are different than skills.
45. How are we going to address the quality of models, given the recent revelations about the lack of documentation and poor software quality of some epidemiology models?
46. Have you approached UKRI to see how they are building their own digital assets for their research centres and funded centres?

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48. I assume you are going to say it'll relate to the BIM interoperability report
49. IFC has a concept of a Model View Definition MVD, with security built in, for the interoperability exchange.
50. Has CDBB tried any DT integrations running these principles at a smaller scale before scaling up to national level? If yes, are there any publication or reports on this? Or is this part of the planned 'prototype'?
51. In respect to skills, are there plans within the framework to work or engage with schools and Further Education establishments by the DTH? This is in essence with careers and informing possible future employees or futurists about the DTH work or aspirations.
52. Great view from Wendy about prospective benefits. Do we have a view on possible timescales for reaping benefits from large scale adoption of IMF conforming DTs, and indeed the NDT itself?
53. Could a tier hierarchy of criteria linked to the digital twin and its proposed use help in categorising the data to relatable 'bundles', thus keeping a structured environment - this may provide a basis for ongoing growth of data and categories
54. I'm keen to have visibility of the practical implementations of work that supports the CDBB agenda. Can you share a list of activities?
55. Has DTH looked at the research work that was undertaken by both the ■D-COM: Digitisation of Requirements, Regulations and Compliance Checking Processes in the Built Environment, Tom Beach, Cardiff University and ■Network FOuNTAIN: Network For ONTOlogies And Information maNagement in Digital Built Britain, Peter Demian, Loughborough University. These were funded research networks in 2018
56. [Possibly] use meta data on the approved quality of twins.
57. Anybody can have skills, but are they competent enough to use them? We need an ecosystem of people's competencies that is part of the NDT.
58. There is a lot of statements about benefits to different groups. Are these benefits/use/values cases being defined anywhere.?
59. Would it be similar to building a base knowledge graph - the way which Google operates?
60. As we [pointed] out previous work, the Pedagogy and Upskilling work, has proposed an ecosystem for People and their competencies to help getting the right people in place to take advantage of the NDT work being discussed here.
61. Please could you let me know if you have a contact with regards working to link up your skills programmes. I currently volunteer as an Enterprise Advisor with SEMLEP.
62. We can't always plan or predict every nitty gritty of what DT will be. It will and must be allowed to evolve! An evolution that we all can trust! Wendy's 'Let it be' sounds amazing.
63. If the NDT becomes autonomous and for the greater good of all, how might this shape our future political landscape?
64. How do you engage researchers from other universities/institutions?