

Digital Twin Ecosystems: Shaping Purpose, Managing Value, Understanding Trust

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DISCUSSION PAPER



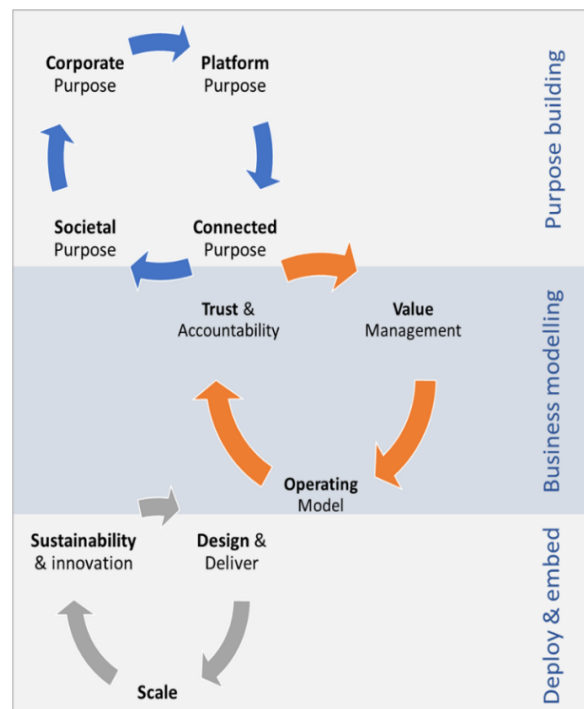
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Introduction

The Governance and Trust working group ('the group') at the Digital Twin (DT) Hub was set-up to advance the foundational work of the Gemini Papers, as they relate to the creation of well-governed, equitable and sustainable connected digital twins. The Gemini Papers and related Principles have established core ideas and next-step priorities for business leaders and policy makers¹; The group's task was to advance these ideas and offer practical, cross-sector guidance for those organisations considering creating, funding, or engaging with digital twins. This discussion paper originated as a draft set of discussion notes in April 2023, drawing together ideas from my research to feed into the group as it worked towards the first Connected Digital Twins Summit².

Shaping Purpose

In the group discussions we moved to a view that digital twins need to be relatively self-sustaining, both financially, and operationally, if not immediately then certainly quite quickly after launch. This links to the notion of a corporate purpose taking centre stage in the design and delivery of a twin. However, some members noted that there are many national agendas that a twin might align with – this is where we establish the societal value proposition of the twin. Further, new technologies generate multiple opportunities, so working with stakeholders to ensure a collective understanding of purpose is essential, if the connected digital twin is to maintain legitimacy within its ecosystem.³



¹ The Gemini Papers were written to address the 'what', 'why' and 'how' of connected digital twins and have been brought under the banner of the Digital Twin Hub to inform and support future work in this domain. The papers can be downloaded here: <https://digitaltwinhub.co.uk/about/the-gemini-papers/>

² The Summit attracted some 900 attendees from 53 countries, representing diverse industries as well as national government, regional government and academia. A full review of the event including videos of sessions can be found here: <https://cp.catapult.org.uk/summit/connected-digital-twins-summit-2023/>

³ For more insight into how collective sensemaking and ecosystem buy-in takes place in major collaborative innovation settings, you can read: Friesl, M., Ford, C. J., & Mason, K. (2019). Managing technological uncertainty in science incubation: A prospective sensemaking perspective. *R&D Management*, 49(4), 668-683.

So, when addressing purpose in the group's first document – which seeks to frame best practice and guide future connected digital twin projects – there are four components to be considered:

- **Corporate Purpose** – Identify the real-world challenge that an organisation is facing, one that requires the creation of advanced modelling and significant collaboration across diverse stakeholders to generate powerful new insights, which will shape new kinds of decision making.
- **Societal Purpose** – Identify the local, regional, and national agendas and government priorities that can be addressed through the solutions that a new (connected) digital twin might offer. These might be direct (e.g. information for better real-time decision making) or more indirect (e.g. opportunities for new business development or regional development).
- **Connected Purpose** – Identify how the value of a proposed new digital twin might be scaled up through connection to, or sharing of knowledge with, other digital twins that currently exist or are yet to be imagined.
- **Platform Purpose** – Identify how the design, delivery and deployment of a new digital twin will build a platform for the creation of new business opportunities, technological and business model innovations, and a driver for growth across a (newly) connected ecosystem of firms.

Purpose drivers are most likely to be either **Corporate** – a drive by a business to address a major issue – or **Societal** – a drive by government with a specific set of issues as its priorities. There is no inherent problem with either approach, but as an advisory group promoting best practice, we should guide such initiatives towards a broader view of purpose from the outset. In this way, government and corporate funding, expertise, and agendas can be brought together in creative and increasingly valuable ways, early in the conceiving of any new digital twin. For example:

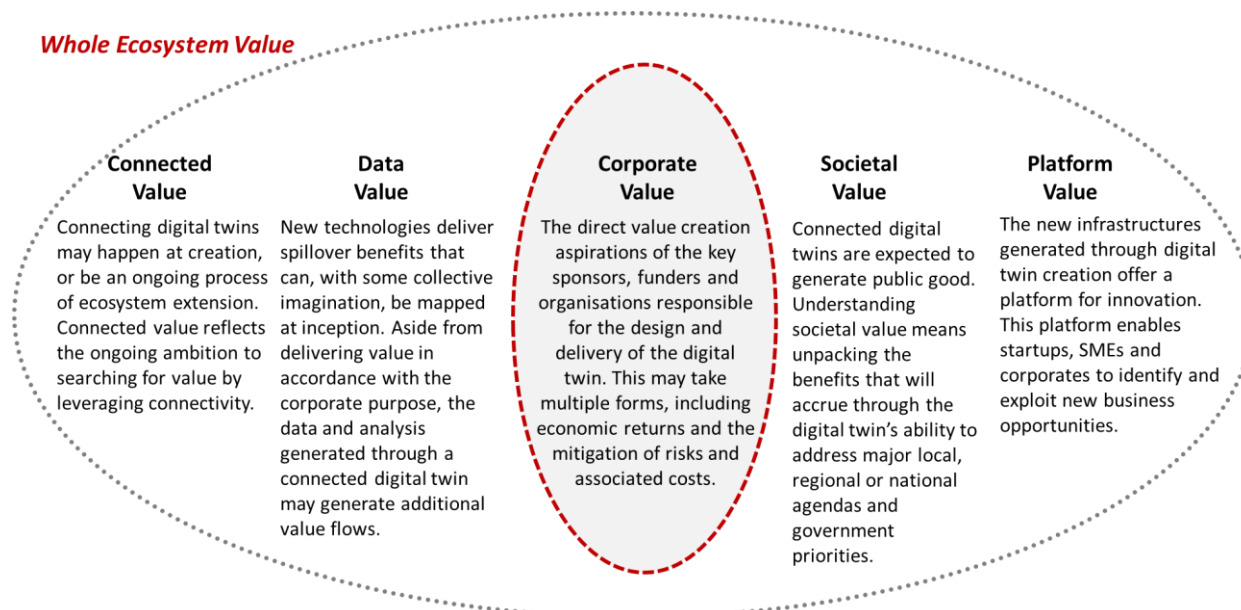
- Putting **Connected Purpose** at the front of the process ensures that we do not end up with digital twins being developed in pseudo-isolation, or worse, without unlocking the motivating power and value promise of an imagined, super-connected digital twin future. For example, building a digital twin of one river and its catchment becomes more valuable to that region if the process is replicated across multiple rivers and weather systems, such that analytical expertise and real time data can enable ever-more accurate forecasting and decision making.
- Putting **Platform Purpose** at the front ensures that we see these new and powerful infrastructures as innovation drivers, not simply solution providers. New knowledge and new ecosystems of firms working together to produce that knowledge, must unlock opportunities of all kinds; This opportunity landscape needs to be considered at the outset so that ideation, innovation and incubation processes are created. This potential is greater when we think about Connected Purpose at the same time, and the scaling potential it offers to innovations.

Managing value

Connected digital twins need the support of a great many individuals and organisations if they are to succeed in being funded, created, deployed, and sustained. To generate and maintain such support, a deep and nuanced understanding of value is required: The value that people, places, organisations and governments need, the timescales they have to work within, and the risks they are willing to bear or contributions they will make in order to generate that value.

As an example of this value plurality, we can compare two distinct approaches to modelling flooding impacts and the value priorities embedded in the purpose and operations of the work being done: The Climate Resilience Demonstrator focusses on infrastructure resilience (energy, water, telecoms) and the reduction of costs, disruption, and decision making uncertainty, so it developed a digital twin of those infrastructure systems; In contrast, as a response to the estimated £500m cost and huge social cost to communities of Storm Desmond in 2015, the recently flooded rivers and tributaries of Cumbria were modelled and tested to better understand the potential mitigating effects of Natural Flood Management (NFM) schemes. Each modelling and prediction endeavour promises great value to society, but to secure funding and access to the resources required for their specific purposes, each approach needed to understand and communicate its value offer to quite different, and diverse, sets of stakeholders.⁴

For those setting out on a connected digital twin project, there are five broad areas of value that should be understood and mapped as purpose stabilizes, and starts to shape the business model:



⁴ Further description of these projects can be found at: <https://digitaltwinhub.co.uk/credo/credo/> and <https://www.lancaster.ac.uk/lec/news-and-events/news/2017/apr/natural-flood-management-could-have-made-a-significant-difference/>

From purpose to business model

The group has robustly discussed the tension between a circular vs linear modelling of the development process of a connected digital twin. Whilst we agreed that we did have some form of cyclical process, there is a concern about revisiting purpose and thereby allowing 'Mission-creep'.⁵

Using the headline concepts of 'Value' and 'Operating Model', these are embedded in a cycle that we can term 'Business modelling', which also includes 'Trust' but alongside the related term 'Accountability'. We can describe this cycle of action along these lines:

Digital Twin business modelling is a process through which capabilities and resources necessary for the creation of a digital twin are assembled. As stakeholders join the twin's nascent ecosystem, the capabilities they bring, and the value they expect to capture for themselves, needs to be discussed and documented. In particular, the different temporal, spatial, and categorical natures of value (financial / social / environmental / etc...) need to be well understood; This understanding enables a business model to be developed that connects an intended Operating Model with the value creation, capture and distribution needs of the ecosystem. Whilst goodwill trust comes into this cycle from a shared belief in the purpose of the endeavour, competence trust needs to build through the cycle of business modelling, and choices need to be made about contracting and accountability to underpin or replace these trust-based foundations.

With Connected Digital Twins I believe we may be orchestrating an ecosystem, not controlling a supply chain. There is a core technological 'product' that needs to be produced but a twin is more than its technological heart, it is a purpose-driven entity that promises rich value creating opportunities for society. So, when we look at capability assembly and value, we need to embed a task here that seeks to identify and classify different bundles of capability more specifically and the ways in which these will be managed or controlled.

Trust

Locating Trust in the model of connected digital twin development is difficult, as it flows through the entire process, rather than sitting as a step or an outcome. For now, much of the more deliberate trust-work might be positioned as part of the business modelling cycle. There is a rich academic literature that looks at trust in multi-organisational settings, the relationships between trust and control, and the different dimensions of trust. Useful for us here are two main concepts: 1) the distinction between goodwill trust (that people want to do the right thing) and competence trust (that people can do what they claim they will do, and that we can see that performance as low risk),

⁵ In prior research we looked closely at how capabilities are assembled in new organisations, and how purpose evolves as new agendas emerge and require incorporation to allow the accumulation of resources essential to the success of the organisation. The paper can be found here: Ford, C. J., & Friesl, M. (2019). Abseiling from the Shard: the cognitive foundations of capability development in temporary organizations. *European Management Review*, 16(3), 507-523.

and 2) the relationship between trust and control, as ways of generating reliable performance and a sense of accountability for action.⁶

Frequently, open innovation initiatives are founded on trust (in senior leaders whose goodwill and competence are well regarded by their organisation) but can then fail because there was no thought for the transition to more robust forms of accountability. Conversely, excessive reliance on formal contracting at an early stage can reduce or remove experimentation, or force smaller entities into positions where they need to withdraw rather than commit resources with limited assurance of value capture as time goes on. Working through these dimensions and relations of trust, control and accountability therefore seems to be a key component of business modelling.

⁶ There has been a great deal of academic research concerning trust, but the initial conceptualisation of trust as comprising elements that reflect *ability* (competence trust) and *intentions* (goodwill trust) was provided by Bart Nooteboom in 1996. Grey and Garsten offer a useful discussion of the relationship between trust, organizational control and the difference between system trust and personal trust. These papers can be found at: Nooteboom, B. (1996). Trust, opportunism and governance: A process and control model. *Organization studies*, 17(6), 985-1010. Grey, C., & Garsten, C. (2001). Trust, control and post-bureaucracy. *Organization studies*, 22(2), 229-250.