

UKRI digital twinning Network Plus: DTNet+: Executive Summary, May 2024

Background: Digital twins are a fusion of digital technologies considered by many leading advocates to be revolutionary in nature. Digital twins offer exciting new possibilities across a wide range of sectors from health, environment, transport, manufacturing, defence, and infrastructure. By connecting the virtual and physical worlds (e.g. cyber-physical¹), digital twins are able to better support decisions, extend operational lives, and introduce multiple other efficiencies and benefits. As a result, digital twins have been identified by government¹, professional bodies² and industry³, as a key technology to help address many of the societal challenges we face.

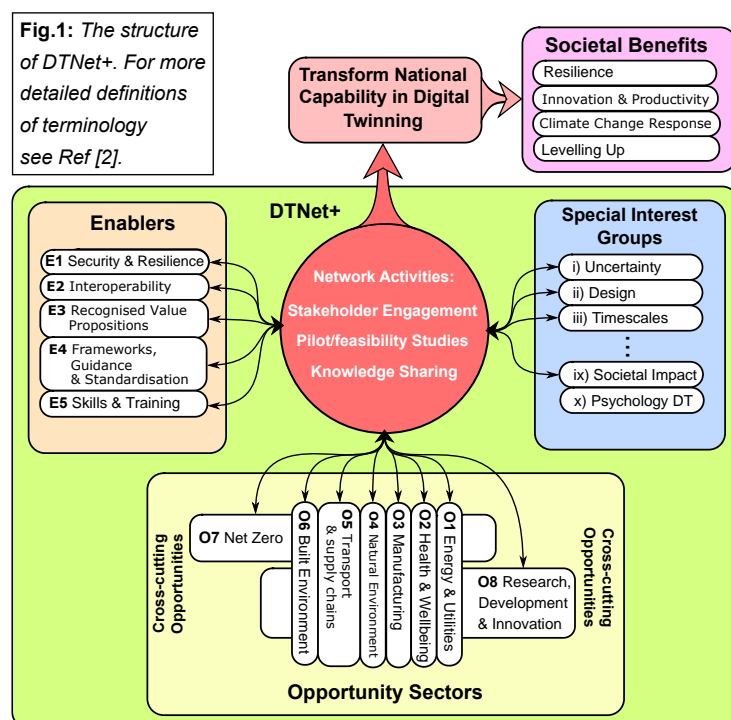
Network vision and objectives: DTNet+ will establish a UK-wide inter-disciplinary research network. This network community will focus on accelerating the development of the underpinning research of digital twinning. Digital twins by their nature, cross multiple disciplinary boundaries, and DTNet+ will deliberately include a very broad community to form a dedicated network that brings together academic research teams with & commercial innovators and practitioners in the UK. DTNet+ will work closely with, and be complementary to, other digital twin networks and consortia. The ultimate aim of DTNet+ is to help accelerate the UK's national capability in digital twinning. The objectives of are to:

- (1) Facilitate knowledge exchange and stimulate new cross-disciplinary collaborations & innovations for digital twinning
- (2) Accelerate the development of underpinning academic research that is needed to develop robust, resilient and trusted DTs that can operate at speed and scale
- (3) Articulate the challenges & help set the UK digital twin agenda via thought leadership
- (4) Facilitate explorative (pilot) cross-disciplinary research projects & feasibility studies that stimulate further funding applications and opportunities relating to digital twins
- (5) Support outreach, skills development & sustainability for digital twin technology

Structure of the Network

The proposed structure of DTNet+ is shown in Fig. 1. The DTNet+ activities are focused on transforming the UK national capability in digital twinning. The transformation will ultimately help deliver societal benefits. This will be achieved by focusing the network activities onto a series of opportunity sectors (including cross-cutting opportunities) in which digital twinning is predicted to produce the highest impact². Attention will also be focused on a set of enablers via which government and other organisations can facilitate and accelerate the adoption and development of digital twin technology².

The DTNet+ activities will be centred on a series of Special Interest Groups (SIGs) that target game-changing research topics across multiple opportunity sectors and enablers.



¹ UK Gov: Cyber-Physical Infrastructure consultation response. March 2023.

² Digital twins for a safer built environment, 2019, IET & Atkins Report.

³ Lifecycle Insights' 2022 Digital Twin Report.

Special Interest Groups: The DTNet+ activities will be centred on a series of Special Interest Groups (SIGs) that target cross-cutting research themes across multiple domains. The current SIGs are; (i) Uncertainty, (ii) Design, (iii) Real- and multi-timescale operation, (iv) Logic, languages, and ontologies, (v) Interoperability, (vi) Scaling, (vii) Resilience & security, (viii) Human-factors, (ix) Societal impacts, (x) Psychology and digital twins

Domain-specific breadth: DTNet+ will include a very broad community. Breadth facilitates cross-sector learning, and ensures research is applicable across a diverse range of applications. The domain specific areas we anticipate being represented in DTNet+ include (but are not limited to): Energy & Utilities, Health, Manufacturing, Natural Environment, Transport, Supply chains, Logistics, Defence, and Societal impact.

Planned Network Activities

General Assemblies (GAs) will be held twice in the first year and once in subsequent years. The focus of the GAs in the first year will be to refine and evolve the initial formulation of the SIGs. From year 2, the GAs will be used as a project annual review meeting, and an opportunity to highlight recent research successes and to identify areas for new collaborations.

SIG Workshops will initially be used to develop a detailed understanding of the opportunities and challenges in each SIG topic area. This will enable the SIG teams to explore methodologies, develop a common language necessary to cross-fertilise ideas and accelerate the research process.

Innovation Workshops will seek to accelerate the potential for DT applications that will ultimately provide societal benefits. Where possible these workshops will be used as opportunities to engage with those tasked with implementing solutions (e.g. government departments).

Pilot Projects will focus on new ideas aligned with SIG topics, and be managed flexibly to offer the greatest value-for-money. 30 pilot projects (4-9 months in duration, £20k - £50k) will be funded. In addition, 10 Feasibility Studies (2-6 months in duration, £10k - £25k) will be funded that can focus on any innovative idea (not necessarily a SIG topic). Early career researchers (ECR) will be particularly encouraged to apply for these resources, and a proportion of projects will be awarded exclusively to ECR-led studies. A sandpit for proposals will be held in Year 1. Open calls for projects will be made in years 2 to 4 and assessed by an independent panel. Call criteria and reviewer metrics will be designed to encourage: (i) alignment to DTNet+ Objectives, (ii) role of ECRs, (iii) research quality, (iv) sustainable delivery, (v) cross-disciplinarity, (vi) industrial support and (vii) EDI. Progress of funded projects will be monitored by the Executive Board (EB) and reported at GAs as part of the annual review. A report recording the findings and any exploitation activities will be required at the end of each project. All projects will include, where possible, a commitment to open-source code development, open data, and open-access publishing.

Thought leadership: The network will develop roadmaps & white papers that provide a vision for the opportunities for UK leadership in DT in an international context that can be used by policy makers, researchers, and industry.

Outreach activities will include: An Early Career Network established within DTNet+ to promote and help establish the research activities of the ECRs. Public engagement will be promoted via participation in science festivals. Collaboration with other networks will be developed by actively engaging with already established networks and consortia with related interests. Research development: We will support the development of research proposals that are of exceptional quality, informed by the Pilot/Feasibility studies. Funding proposals are intended to be complementary to existing related activities.