UKRI and Digital Twins

Mark Gaskarth

Head of Digital Twins - EPSRC

What is UKRI?

HM Treasury

Department for Business, Energy & Industrial Strategy

UK Research and Innovation

- Engineering and Physical Sciences Research Council
- Economic and Social Research Council
- Science and Technology Facilities Council
- Medical Research Council
- Research England
- Innovate UK
- Biotechnology and Biological Sciences Research Council
- Natural Environment Research Council
- Arts and Humanities Research Council

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What do we mean by the term digital twin?

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Digital twins at different scales - verticals and horizontals

(Slide kindly supplied by Rolls Royce)

|	AUTOMOTIVE	PHARMA	ENERGY
Multi Domain 'Decision' Twin **Operation Optimisation Twin** **'National digital Twin'**	All traffic on UK road infrastructure	The National Health System	'The Grid'
Fleet Operation Twins **Fleet Maintenance Twins** **End of Life 'Obsolescence' Twin**	Fleets of Cars	Population of Patients	Network of Plants
Integrated system Twin **Asset Operation Twins** **Asset Maintenance Twin**	Car	Patient	Nuclear Plant
Component Twins **Component (sub) system twins** **Component 'lifing/ageing' Twins**	Motors / Batteries / Brakes	Drug / Vaccine	Sub systems
Smart Factory Twins **Supply Chain Twins** **Maintenance Network Twins**	Production Solution / supply chain	Ingredient formulation, Drug / Vaccine Production	Production /Supply Chain
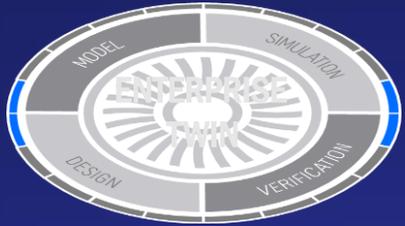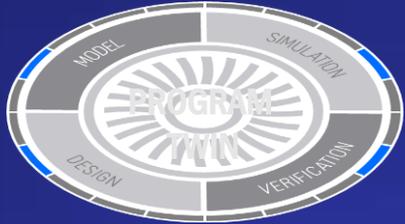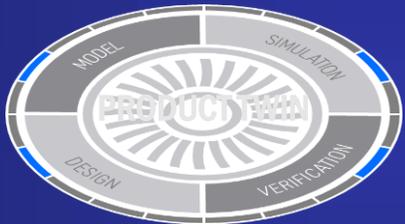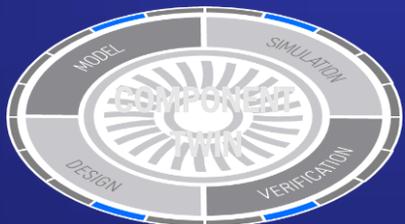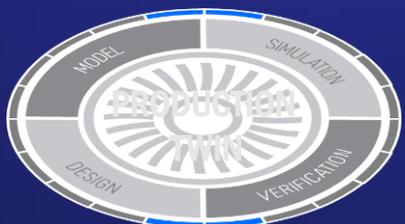
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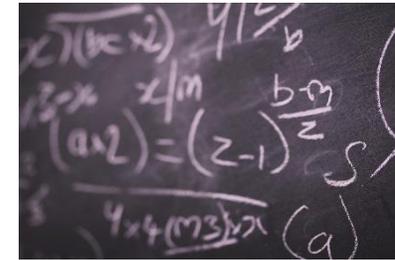
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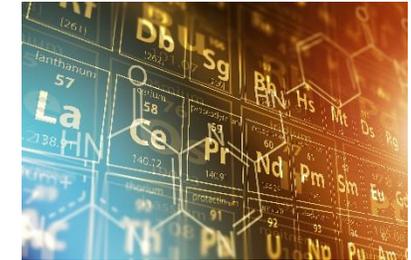
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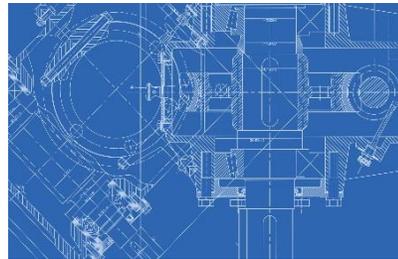
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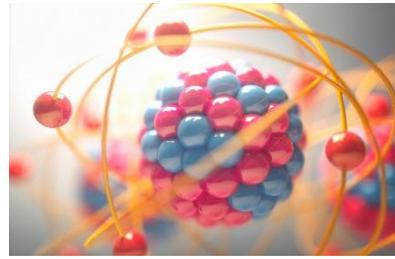
healthcare technologies

digital economy

cybersecurity

AI & robotics

ICT

quantum technologies
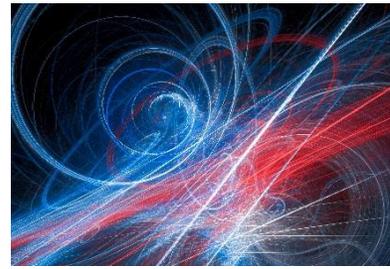
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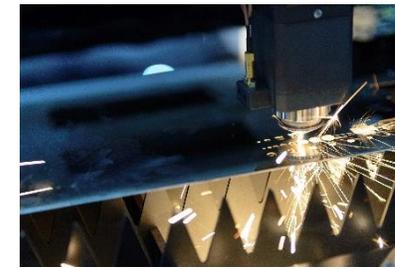
energy

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Digital twins – current UKRI investments

UKRI Digital Twin investments include studentships, research, infrastructure, collaborative R&D and SBRI.

Sectors include: Clean Growth and Infrastructure, Manufacturing, Materials and Mobility, and Responsive (open).

Many projects were funded under separate, non-connected competitions where Digital Twins were in scope – *but not the main aim.*

UKRI has also invested in digital twin-specific projects, programmes, and fellowships, notably including a £5m investment in digital twins for improved dynamic design (DigiTwin) and £6m for advanced simulation and modelling of gas turbine engines (ASiMoV).

THE UNIVERSITY *of* EDINBURGH

ROLLS ROYCE **ASiMoV**

cfms

ZENOTECH

DAFNI

The Alan Turing Institute

DigiTwin
Digital twins for improved dynamic design

CMAC
FUTURE MANUFACTURING RESEARCH HUB

Project Examples

Green circles show 2m+ between passengers
Red circles show passengers that are too close

OpenSpace

Real-time geospatial digital twin to manage people flow in rail station

WINDRACERS

Swarm technology and digital twinning to coordinate high numbers of 100kg payload UAVs in aid delivery and firefighting applications

UK Digital Twin Programme - potential objectives

Build the cyber-physical foundations

Develop the next generation

Increase adoption and commercialisation

Digital twins (DTs) – potential transformation

DTs used in highly controlled environments → DTs used widely and for the public good

DTs used by DT specialists → DTs co-developed by DT specialists and users → DTs used by a wide range of people who derive high levels of value from them

DTs bought from a small number of suppliers, or on a pay to play model → Digital twinning available to all (like the www), and not owned by a few

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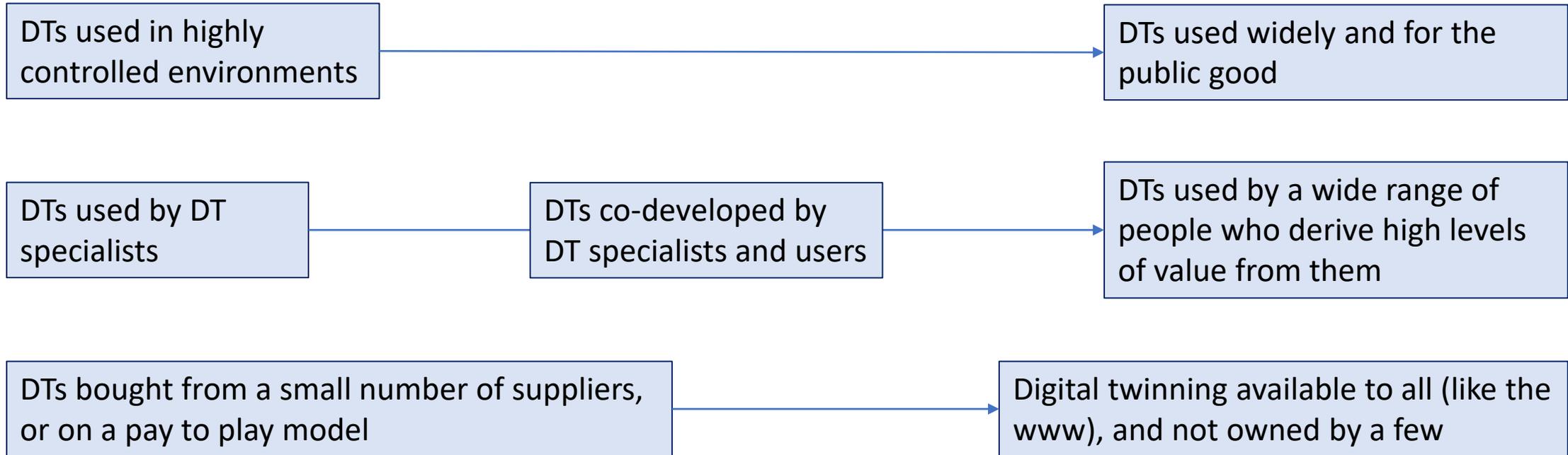
Digital twins (DTs) – potential transformation

DTs developed
and used in isolation

$\longrightarrow$

A critical mass of skilled people
and integrated investments, anchoring a
national capability in the UK

A lack of tools, frameworks,
incentives, and regulations,
stifling integration

$\longrightarrow$

Frameworks, guidance, standards,
regulations, and cyber-physical
infrastructure, building on UK strengths
and values

Digital models offering
relatively low levels of value

$\longrightarrow$

DTs that are trusted, secure, resilient,
and sustainable, and that can operate
with and for people, in high fidelity, in
real time, and using machine learning
where required, federated with other
DTs to enable decision making at
multiple layers of abstraction, and across
systems and sectors.

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Over £1m of additional EPSRC funding for DAFNI

Enabling DAFNI to:
- Widen its usage and capability, supporting EPSRC's Engineering and related research programmes over the next two years.

- Extend the relationships established in the development phase to look beyond academia to industry and government to build collaborations.

Key points to take away:

- I would encourage those who are conducting research into digital twinning in academia, industry or government to seize this opportunity and to engage with DAFNI.

- BEIS and UKRI will be conducting a summer of engagement on cyber-physical infrastructure and digital twins.

Mark Gaskarth
Head of Digital Twins – EPSRC
mark.gaskarth@epsrc.ukri.org