



**UK Research
and Innovation**

UK Research and Innovation

- We are the largest public funder of R&I in the UK
- We bring together nine councils covering all sectors and disciplines
- We are a public body and accountable to government
- We are part of a system, working with academia, business, public sector, third sector, and international partners

Transformative technologies

- Technologies can underpin discovery and innovation
- They can open up new fields of research and new opportunities for businesses and public services
- They can also make research, businesses and public services much more efficient
- Historical examples tend to involve technologies to do specific tasks better- more sensitive measurement tools, or transformative ways of performing a task



Transformative technologies

- Microscopy (Nobels 2008, 2014, 2017)
- Telescopes (Nobels 1974, 2020)
- Genetic modification (Nobels 1993, 2007, 2020)
- Robotics and automation



Transformative technologies and the digital revolution

- As a result of past technological revolutions, the ability to capture key measurements and perform particular tasks are no longer the main rate limiting step
- The new focus is on the relationships between things
- This requires us to understand systems and processes
- Non-linear dynamics and feedbacks are typically central
- We have very poor intuition for these processes

Linear stories

- We think in linear stories with a beginning a middle and an end
- We are drawn to cause and effect explanations



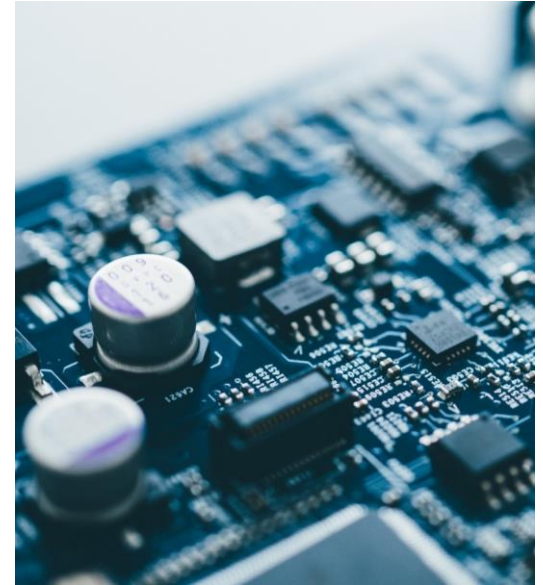
SMART objectives are everywhere

- Specific
- Measurable
- Attributable
- Realistic
- Time limited



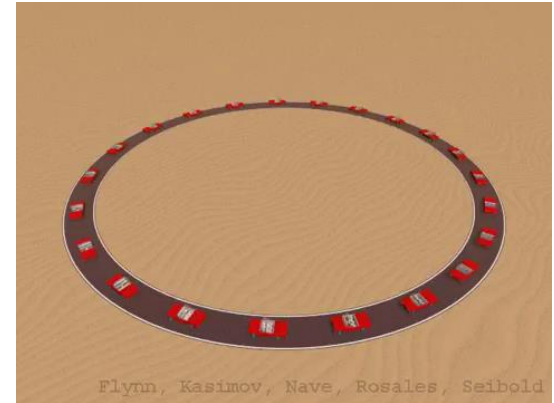
Non-linear reality

- Most systems of interest do not have a beginning, a middle and an end
- Cause and effect are not meaningfully separable in a feedback loop
- SMART objectives can inhibit progress



Non-linear reality

- Tipping points – standing ovations
- Feedbacks – traffic waves
- Emergence – Conway's game of life



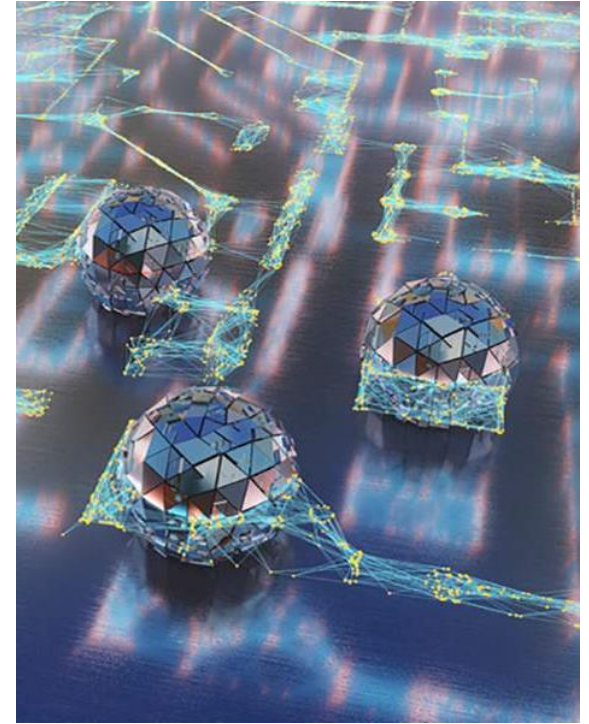
New transformative technologies

- The next generation of Transformative Technologies are ways of identifying and measuring the relationships between things and their dynamics
- The focus has moved up a level from parts to their interactions.



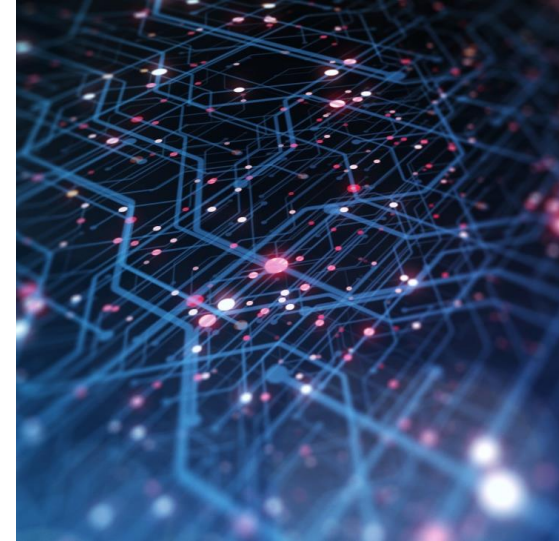
Next generation transformative technologies

- Artificial Intelligence (AI)
- Digital Twins
- Engineering Biology
- Quantum Computing
- Autonomous systems



DAFNI

- Modelling, simulation and visualisation
- Supporting national infrastructure plan
- System of systems approach



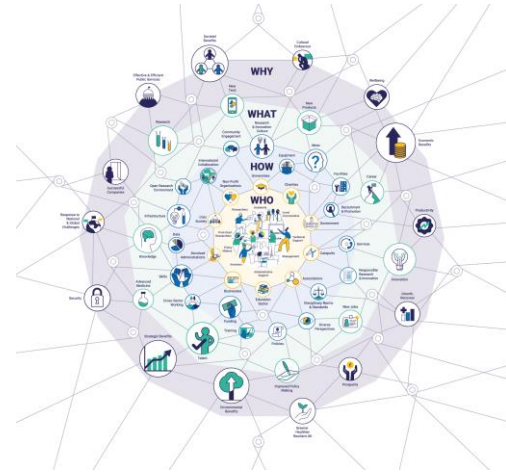
Developing understanding and intuition

- Visualisation is key in developing publics and policy-makers' intuition
- The ability to connect researchers, innovators, regulators and users can accelerate impact



TTs in the R&I system

- Public value is central, e.g. Digital Twins focus on transport, housing, health
- Should lead to better integrated and faster decisions, improving wellbeing for citizens
- Symbiotic relationship between dynamic, inclusive R&I system - Transformative Tech

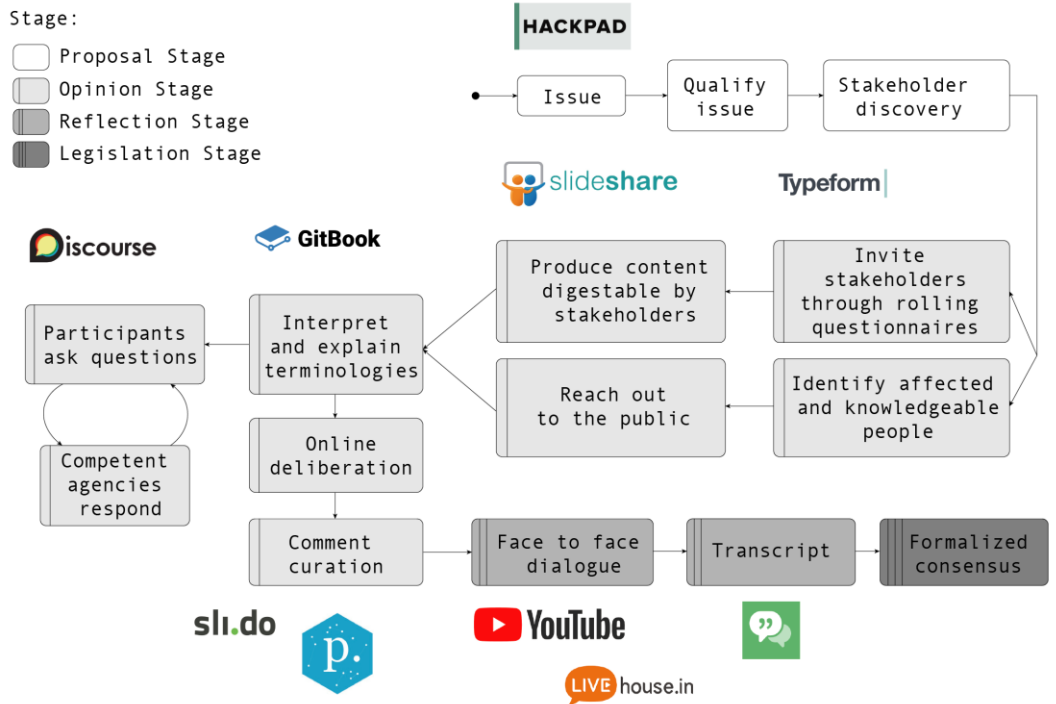


An example - vTaiwan

- Using technology to crowdsource democracy
- Engaging civil society in co-creating policy solutions
- Visualisation and data science aids participation

Stage:

- Proposal Stage
- ◐ Opinion Stage
- ◑ Reflection Stage
- ◒ Legislation Stage



Challenges

- Adoption and diffusion of technology
- Accessibility
- Inclusivity
- Communication
- Sustainability





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Thank you



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