Event themes (500 - 700 words)

Theme 1: The fundamental of digital twin and how does it accelerate the R&D of process and system

Four distinguished speakers were invited to give keynote talks: Prof. David Wagg from the Alan Turing Institute, Prof. Antouela Takou from Nottingham Trent University, Prof. John Erkoyuncu from Cranfield University, and Dr. Sang Phil Han from Siemens. All speakers presented insights into the fundamentals of digital twins and the application of digital tools to enhance research and development in chemical, mechanical, and biological processes and systems. Prof. Wagg delved into the philosophical foundations of digital twins, explaining their underlying principles and potential impacts. Prof. Takou highlighted the use of simulations to evaluate the circular supply chain for medical devices within the healthcare sector, demonstrating practical applications and benefits. Prof. Erkoyuncu discussed how digital technologies can improve process efficiency and resource utilisation, offering a broad

overview of advancements in the field. Dr. Han introduced the cutting-edge digital twin-based process simulation software developed at Siemens, showcasing its capabilities and applications. Together, these talks provided a comprehensive view of current trends and future directions in digital twin technology.

Theme 2: How does digitally enable innovations to accelerate sustainability and circular economy

This theme featured insights from Prof. Benoit Chachuat from Imperial College London, Prof. Nicholas Watson from the University of Leeds, Prof. Bing Xu from Heriot-Watt University, and Mr. Robert Purchase from Yokogawa. These speakers discussed the pivotal role of digitally enabled innovations in fostering a more sustainable future for businesses. Prof. Chachuat demonstrated the use of digital tools in the sustainability assessment of early-stage chemical and fuel technologies, emphasising their critical impact in the initial phases of development. Prof. Watson focused on the agri-food sector, illustrating how machine learning and AI can significantly enhance sustainability in this area. Prof. Xu presented a systems approach to transitioning the chemical industry towards a circular economy, outlining the strategic integration of processes and technologies. Meanwhile, Mr. Purchase highlighted the sustainability goals and initiatives at Yokogawa, providing a corporate perspective on embracing digital innovations for environmental sustainability. Together, these talks offered diverse perspectives on leveraging digital technology to advance sustainability across various sectors.

Panel discussion:

Chaired by Prof. Bing Xu from Heriot-Watt University, Prof. David Wagg from Alan Turing Institute, Prof. Nicolas Watson for University of Leeds, Prof. Eileen Yu from Loughborough University, Dr. Song Phil Han from Simens, and Dr. Eberechi Weli from Global Centre of Excellence in Sustainability were invited to share their insights on the impact of digital technology in a chaired discussion. They explored three key questions:

1. How does digital technology enable the circular economy?
2. What benefits do digital innovations bring to their research?
3. How does digital technology enhance the operational efficiency and competitive edge of industry?

Each expert brought unique perspectives to these topics, discussing the transformative potential of digital tools in promoting sustainability, advancing scientific inquiry, and boosting industrial productivity and competitiveness. This session provided a comprehensive overview of the strategic integration of digital technologies across various fields and industries.

Ideation workshop: How does digital technology interact with the circular economy to foster mutual development?

Chaired by Dr. Lei Xing from University of Surrey, the workshop participants were divided into three groups, each led by a representative to deliberate on specific topics:

Topic 1: Leveraging digital twin technology to optimize circular economy processes and promote circular economy businesses.

Topic 2: Applying circular economy approaches to digital technologies to sustain their development.

Topic 3: Implementing IoT infrastructure and cybersecurity to support a digitally enabled circular economy.

After a 15-minute discussion, representatives from each group—Dr. Oliver Fisher from University of Nottingham for Group 1, Dr. Regina Frei from Univresity of Surrey for Group 2, and Dr. Ben Cummings from University of Surrey for Group 3—shared their discussed conclusions with the other groups.

Next steps - Outcomes

- Dr. Lei Xing and Prof. Benoit Chachuat discussed the co-supervision of PhD students and the publication of joint papers.
- The two invited companies, Siemens and Yokogawa, expressed their potential support for future collaborative funding applications.
- The Surrey team engaged with workshop participants regarding recent EPSRC funding calls, such as "Sustainable Industrial Futures" and "Manufacturing Research Hubs for a Sustainable Future: Outline."

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