NATIONAL CYBER-PHYSICAL INFRASTRUCTURE ECOSYSTEM

Department for Science, Innovation & Technology

NCPI WORKSHOPS

Key challenges

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WORKSHOP OUTLINE

Key challenges

Cyber-physical infrastructure is the invisible infrastructure that connects the real world with the digital world.

It is a broad capturing of many aspects including technology, different sectoral approaches, and the collective grand challenges we face. It is through the ecosystems collective efforts to make advancements in our infrastructure that we can be better enable the advancements to our respective needs to achieve the benefits.

This short report summarises the first workshop in the series that brought together the broad range of stakeholders from across the ecosystem to highlight the key recommendations across all six strategic areas.

Mark Enzer OBE provided key opening reflections about the unique form of this connected ecosystem covering the interfaces through people, digital and physical characteristics. Further reflections was provided by Dr Christina Yan Zhang from The Metaverse Institute articulating how NCPI fits into the metaverse world and other supporting international activities.

A panel discussion delved into what is still collectively needed to achieve the significant advancements spoken about supported by Paul Clarke CBE - Co-chair Robotics Growth Partnership; Graham Faiz - DNV, Asha Easton – Innovate UK; Mark Enzer OBE - Mott MacDonald and Denzil Lawrence, Boeing Research & Technology chaired by Jonathan Eyre, High Value Manufacturing Catapult.

NCPI Workshop on Key Challenges

Hosted at University of Sheffield's Advanced Manufacturing Research Centre, Sheffield

Agenda, 16th May

13:00 Opening remarks - Mark Enzer OBE

13:10 Reflections from The Metaverse Institute

Dr Christina Yan Zhang

13:15 Panel Discussion - Diversity of Thought across Disciplines

14:15 Roundtable discussions for key challenges

15:30 Table feedback and major outcomes

WORKSHOP OUTPUT

Delivery of recommendations

Stakeholders discussed challenge areas to capture key priority recommendations for the ecosystem.

Roundtable findings were captured from across the tables, with a nominated speaker from each table feeding back to the room to collate all findings together across the event.

This method ensured the ecosystem were able to have facilitated discussions together to convene key issues and challenges for increasing the ecosystem maturity of cyber-physical infrastructure.

The recommendations from this key challenges event created a consensus across the ecosystem covering diverse domains, sectors and technology areas.

In summary, the attendees recognised the critical need for cyber-physical infrastructure alongside the major challenges holding back it being established.

Security and resilience

Supporting the development of systems that can withstand attacks and failures, both at an application level and nationally, such as systemic supply chain risks

Interoperability

Ensuring different organisations and systems can connect and communicate as easily as possibleagnostic integration, it will ensure substitutes continue to be of low risk.

Recognised value propositions

Supporting the development and communication of the knowledge of how to develop and apply cyber-physical systems and the value they deliver, to facilitate investment

Frameworks, guidance and standardisation

Supporting the collaboration required to develop the common language, approaches and technical requirements for development and deployment, with the subsequent dissemination

Skills

Supporting the development of technical and non-technical skills required to develop a national capability in cyber-physical infrastructure

Regulation

Offering clear rules of the road to developers and users of the cyber-physical infrastructure

ROUNDTABLE VIEWS

"Cyber dependencies and their connections to the physical world are not well understood or articulated."

Security and Resilience

"Interoperability enhances system decoupling and modularity, creating a 'true plug-and-play environment'."

Interoperability

"Cyber-Physical Infrastructure development must target real problems that deliver tangible value."

Recognised Value Propositions

"Many existing frameworks, guidance and standards should be leveraged before developing new ones."

Frameworks, guidance and standardisation

"Regulated infrastructures and distributed systems are complex and not intuitively understood."

Skills

"The appropriate level of regulation for this infrastructure is currently unclear."

Regulation

ROUNDTABLE INSIGHTS

"The differing development lifecycles of software and hardware make timely software updates critical for security and preventing obsolescence."

Security and Resilience

"Interoperability strengthens resilience against system disruptions."

Interoperability

"There are successful siloed examples that can be expanded to develop broader infrastructure."

Recognised Value Propositions

"Best practices must address both legacy systems and future connected infrastructure."

Frameworks, guidance and standardisation

"Ongoing digital transformation demands that decision-makers receive training to have the necessary skills."

Skills

"Clear and unambiguous regulation is essential for fostering trust and ensuring proper governance."

Regulation

CONSIDERATIONS

Key thoughts captured from participants

Speakers and attendees discussed the need to have **intuitive open-access living labs** for any future infrastructure emphasising the need to **prioritise security and resilience** from the outset, with the ability to manage shocks and adverse trends. "**Security by design"** must be embedded based on real needs, not as an afterthought. In addition, a vision **articulating future infrastructure practices** with where and how to get started alongside the emerging future state picture aids communication for all stakeholders to benefit from.

Information sharing was advocated for with a strong desire for **discoverability through federated and distributed** methods to enable data re-use and removing current mandraulic non-value added time, which in turn maximises the value of existing information. Consideration was made to the cost of producing data and ongoing ownership, urging **decision-makers to look beyond just the end benefits** with the need to account also to the cost of capturing, processing, storage and ongoing maintenance. The long-term sustainability effects of data must be taken into account through understanding both the information requirements stipulating what needs to be captured and also the end of life for data for safe deletion.

Interoperability was highlighted as playing **a role in all key challenge areas** enabling seamless discoverability of information between humans, physical systems and machines. This required **appropriate skills** and **open-access best-practice demonstrations** across the full range of social and technological interoperability areas **prior to standardisation or government mandate**. It is through these advancements that **market opportunities,** in particular for small to medium-sized business, can be created in a **"true plug and play ecosystem"** due to the advantages seen and wider modularity benefits.

Frameworks, guidance and standards must be grounded on top of strong, clear enforceable regulations when required. Guidelines were discussed as being the easiest to follow, only requiring stronger enforcement of "best practice", national or international standardisation or mandated regulation when needed. Different sectors regulate different aspects to different degrees, emphasising the need for sectors to establish a common baseline of capabilities for future infrastructure.

Finally, cyber-physical infrastructure was considered **a critical and necessary paradigm shift** to current industrial practices that we must transition towards. This may require a leap of faith by early adopters to path the way ahead, however technology was not seen as the key blocker. Rather our ability to articulate how we wish to design the accountable between systems and decisions making powers.

RECOMMENDATIONS

Key actions to advance cyber-physical infrastructure

Outline recommendations from the workshop to the Department for Science, Innovation and Technology (DSIT), for further consideration through interviews.

To enhance resilience, future infrastructure should mandate cyber-physical components from the outset. UK initiatives are pushing forward for some aspects, but further support towards them is needed. Developing frameworks for federated data ecosystems will drive long-term innovation, aligning with the broader goal of creating resilient and adaptable systems.

1. **Embed Resilience in Infrastructure:** Future infrastructure projects must mandate cyber-physical infrastructure components from the outset and critically within procurement activities to enhance security, operational value and overall adaptability.

2. **Support Long-Term Innovation and System Design:** Build frameworks for distributed and federated data ecosystems, whilst avoiding compromising shortcuts towards broader long-term objectives.

RECOMMENDATIONS

Key actions to advance cyber-physical infrastructure

Outline recommendations from the workshop to the Department for Science, Innovation and Technology (DSIT), for further consideration through interviews.

Minimal interoperability standards enable seamless technology integration. Clear and enforceable regulations, with sector-specific and personal data guidelines establish measurable compliance. Data-sharing frameworks must build on the value of shared information promoting cross-sector collaboration.

Government must provide proactive support and leadership to drive interoperability and set regulatory direction, positioning digital and data as essential national infrastructure to support economic growth.

3. **Establish Clear Standards for Interoperability:** Develop and mandate minimal interoperability standards across physical, digital and organisational aspects to ensure systems and technologies work seamlessly together.

4. **Prioritise Clear and Enforceable Regulations:** Regulations, especially personal and sector-specific, should be unambiguous to universally ensure testable compliance.

5. **Encourage and Regulate Data Sharing:** Promote data sharing frameworks that can demonstrate and articulate the value of shared information while addressing legal, contractual, and governance challenges fostering collaborate between sectors.