



Innovation
Launchpad
Network+



CASE STUDY

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The Challenge

In the aerospace, defence and automotive industries, customers increasingly desire more than the production and provision of goods, and often require ensured support with through-life services. Original equipment manufacturers (OEMs) operating in these industries are increasingly reliant on their spare parts supply chains to satisfy customers and deliver on contractual responsibilities in the through-life service market. It is essential resilience is built into these supply chains to ensure business continuity in these markets. In recent times spare parts supply chains have been hampered by disruptions, hindering their ability to deliver spare parts on time and in the right quantity to their customers. Additive manufacturing (AM), an emerging production technology, has the potential to enhance organisation's ability to respond flexibly, more dependably and with faster lead times than traditional supply chains without OEMs needing to hold costly inventory as these can be stored digitally. However, adoption of AM has been low and barriers to its use within spare parts supply chains remain significant. This project sought to address this challenge and translate and advance the research from the Responsive Additive Manufacturing to Overcome Natural and Attack based disruption alongside the Digital Supply Chain Hub at the Digital Catapult.

Innovation

Through these outputs and co-created research, this project advanced and refined a double-lock integrity managerial framework for securing additively manufactured parts. This approach addresses the limitations of conventional tagging and tracking technologies like RFID tags and QR codes. The double-lock incorporates unique physical anchors during the manufacturing of AM components and secures them with Smart Contracts on a permissioned blockchain, providing a 'second lock'. The proposed physical-to-digital interface, refined through expert interviews with individuals from industry and the Digital Catapult, enhances the security, traceability and resilience of AM business interactions and supply chains against physical and cyber threats.

The study emphasises the potential impact of this technology across critical industries where the security and authenticity of parts are essential, such as defence, healthcare, and aerospace. Similarly, non-critical industries currently using or evaluating the potential of AM in their business models can use the framework discussed in this paper to make stronger use cases. The double-lock system offers a flexible solution that supports internal operations and external partnerships in complex supply chains. By ensuring that goods and transactions are recorded and verifiable against a private digital ledger, the system also introduces an additional layer of transparency and trust that could benefit traditional operations where component provenance is becoming increasingly valuable.

Result

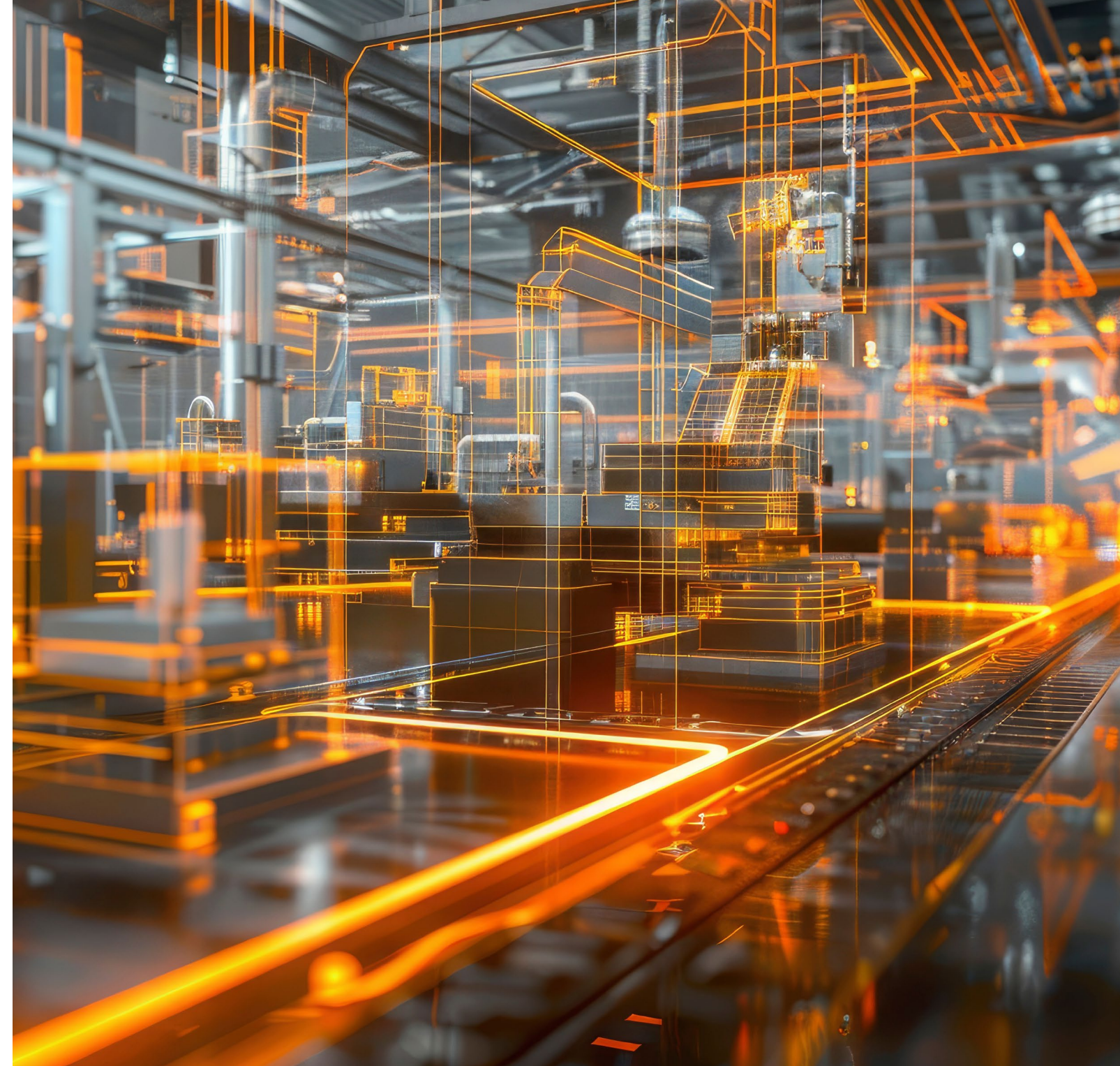
The project delivered tangible research and engagement outcomes:

- A validated Dual Materiality Framework tailored for manufacturing, supported by strong positive feedback from industry partners during a workshop.
- Identification of key real-world challenges for cyber security in Additive Manufacturing Supply Chains.
- Progressed on a second paper, proposing the dual materiality framework.

- Strengthened collaboration between the University of Bristol and the Digital Catapult, leading to ongoing discussions for further funding opportunities.
- Submission of a competitive grant application.

Impact

Our study emphasises the potential impact of this technology across critical industries where the security and authenticity of parts are essential, such as defence, healthcare, and aerospace. Similarly, non-critical industries currently using or evaluating the potential of AM in their business models can use the framework discussed in this paper to make stronger use cases. The double-lock system offers a flexible solution that supports internal operations and external partnerships in complex supply chains. By ensuring that goods and transactions are recorded and verifiable against a private digital ledger, the system also introduces an additional layer of transparency and trust that could benefit traditional operations where component provenance is becoming increasingly valuable. The project laid strong foundations for continued innovation, including plans to develop a user-friendly software interface and explore commercialisation opportunities. These developments will support future industry uptake and help establish reliability-based optimisation as a viable design pathway for next-generation FWT systems.



Phil Walker-Davies

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“Collaborating with the Digital Catapult has been a fantastic and insightful experience. Not only did we deliver the dual materiality framework, we also advanced other avenues for joint research, contributed to my continued professional development, and created lasting links beyond this project”.

Digital Catapult