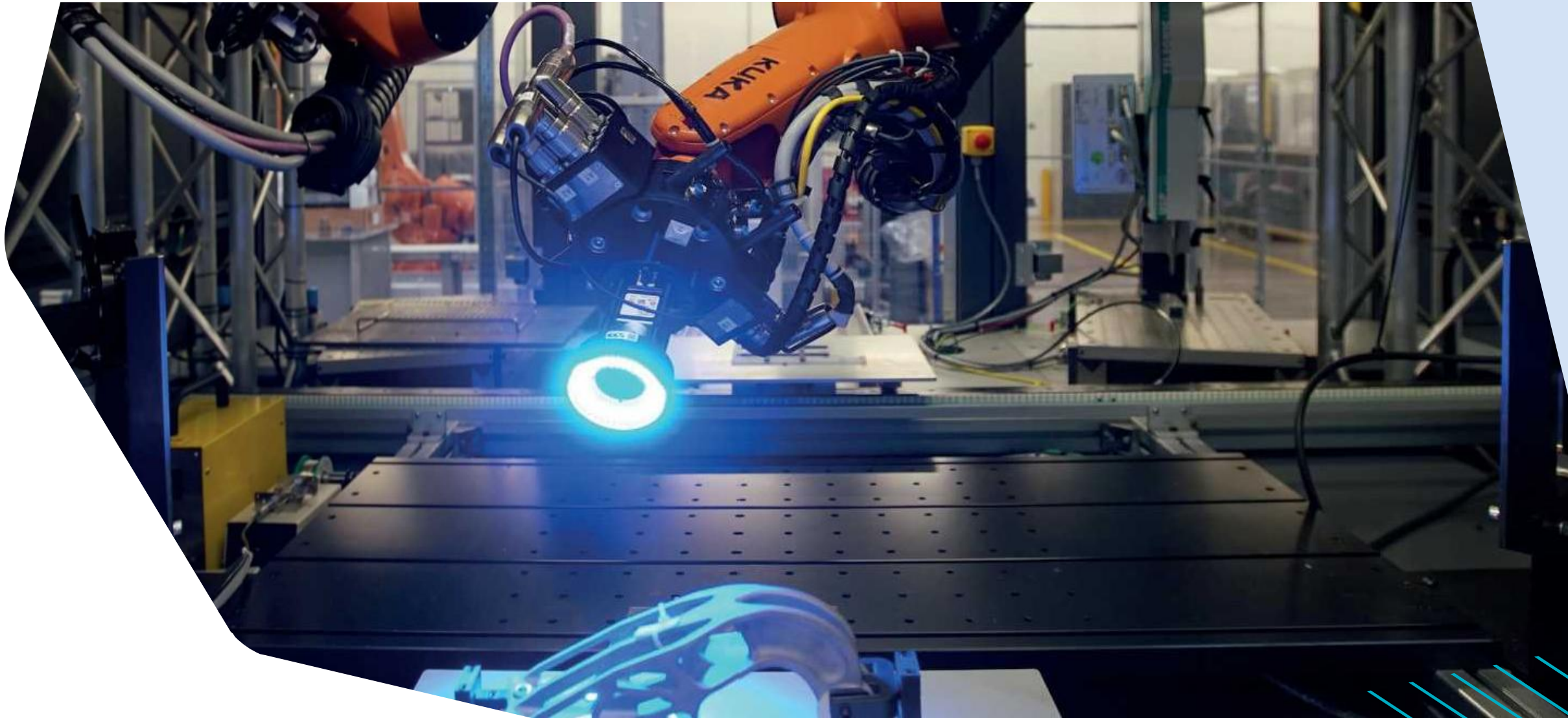


Assurance

V1.0 – April 2026

CATAPULT
High Value Manufacturing



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Assurance

Processes, practices and technologies used to provide confidence that new and existing manufactured products or systems will meet design requirements, standards, regulations and codes through inspection, measurement and test.

Why: Demand drivers

- Assurance barriers to adoption of advanced and flexible manufacturing technologies
- Assurance challenges for circularity remanufacture and maintenance
- Integrated digital manufacturing and assurance data traceability
- Assurance capabilities aligned with increasing high-value manufacturing rates and product complexity.
- Advancing assurance certification and regulatory pathways

What: Priority industry capability needs

- Accepted methods and frameworks to ensure single source of truth for assurance data
- Advanced use of data and simulation across quality and certification activities
- Encourage adoption of secure digital sharing of assurance data among supply chains
- Simplified approaches, software and AI to address assurance challenges.
- Acceptance of in-process practices as definitive and credible sources of inspection and measurement

How: Priority innovation requirements

- Cost/benefit/risk analysis framework for investment in inspection, measurement and test activity
- Process certification by analysis, reducing physical testing through analysis and in-process techniques
- Automating credible digital traceability of quality and certification data
- Assurance for maintenance, repair and overhaul/remanufacture, repurpose, reuse and recycle.
- AI developed towards accelerated certification pathways, automated decision making, inspection, measurement and test



Assurance is essential to ensuring that products brought to market are compliant, safe and reliable. Industry is experiencing a rapid increase in product complexity, novel designs and expectations for extended life and circularity. Yet organisations are under pressure to deliver high-quality products faster, at lower cost and with less waste. Supported by HVM Catapult, the UK has an opportunity to embrace emerging technologies and rethink approaches to assurance, accelerating the development of modern products, processes and standards.

Key HVM Catapult capabilities in assurance

Infrastructure NDT, MTC (Coventry)

Using advanced vehicle mounted ground penetrating radar paired with commercial software and bespoke analysis to provide visualisation and insight into bridge structures and potential defects without the need for a full conventional intrusive bridge deck examination.

National research facility for lab-based XCT, WMG (Coventry)

Advancing scanning technologies, such as high-resolution laser scanning and microfocus CT, to enable 3D characterisation of internal and external structures in support of a wide range of small to large-scale applications.

Automated inspection, Validation and NDT, NCC (Bristol)

As demonstrated in the Airbus Wing of Tomorrow programme. Provides advanced automated inspection solutions, including robotic ultrasonic testing and in-process monitoring, to ensure quality assurance and certification readiness for composite and hybrid structures.

Automated in-process monitoring, AMRC (Sheffield)

Advanced in-process monitoring capabilities to enable autonomous systems, focusing on: non-intrusive sensors, high-speed connectivity, computational intelligence, process certification and real-time adaptive control.

Product process regulatory compliance, CPI (Renfrew, Darlington, Sedgefield, Wilton)

Expertise in compliance across GMP, ISO13485 and FSSC 22000 (pharmaceutical, medical device and food/feed), including critical quality attribute (CQA) and critical process parameter (CPP) development and analysis.

Residual stress measurement and strain mapping, NMIS (Renfrew)

Advanced residual stress measurement and strain mapping capabilities using diffraction-based techniques, mechanical methods and digital image correlation to evaluate forming processes, validate simulations and optimise structural performance and component integrity.

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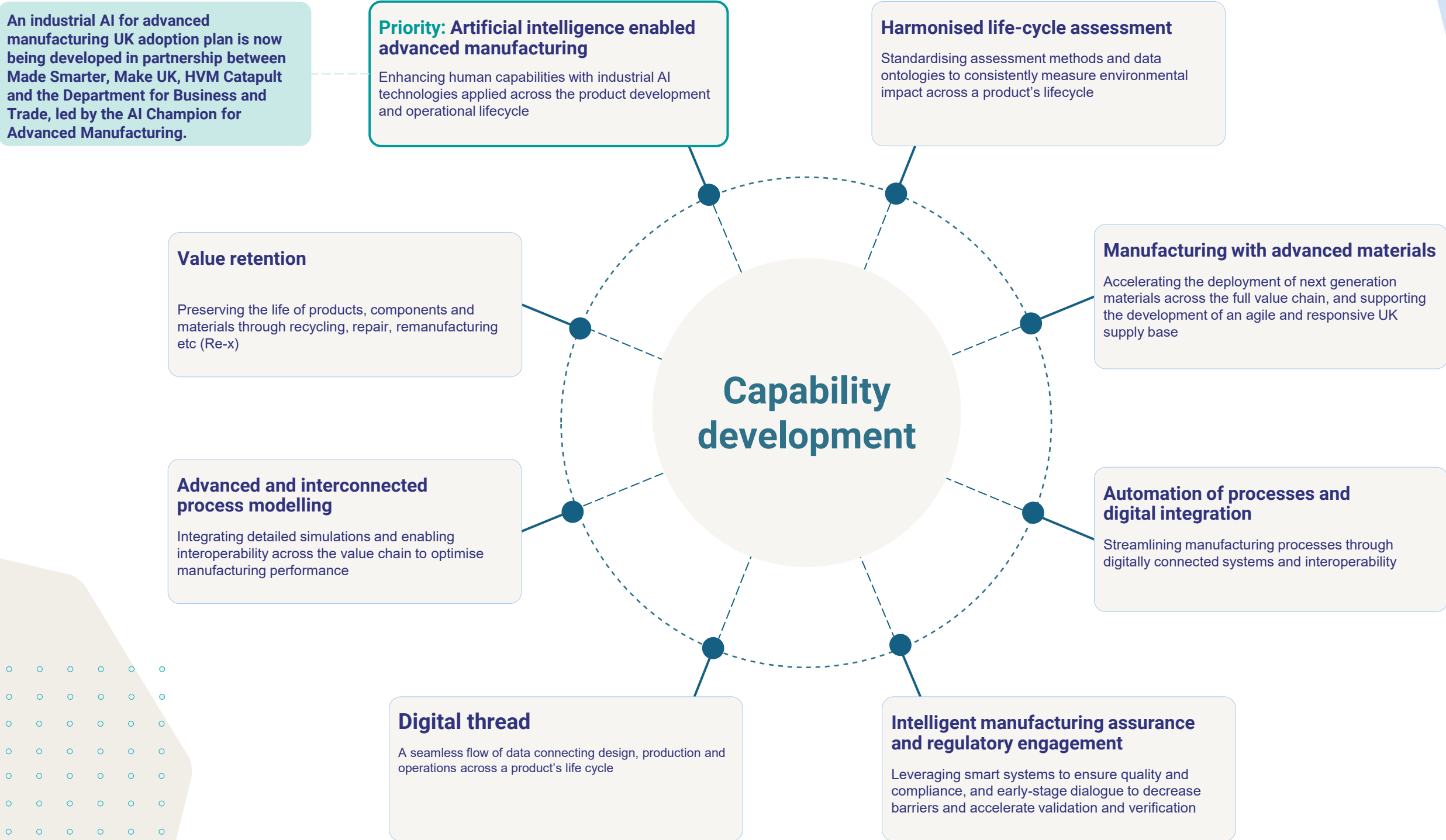
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Connected technology platforms

Through cross-domain analysis, eight connected technology platforms have been identified. They underpin both the core advanced manufacturing process technologies and the cross-cutting enabling technologies set out in this strategy.

They provide a shared foundation of insight and collective capability, showing where coordinated effort across our domains can best strengthen, connect and accelerate the technologies that matter most to UK industry.



Interpreting our roadmaps

The strategy structure

Why: Demand drivers

External pressures or opportunities that create the need for new or improved manufacturing capabilities.

What: Industry capability needs and priorities

The practical abilities industry must have to remain competitive in the future and the priorities for HVM Catapult.



Priority industry capability needs

The most critical capability gaps identified through industry consultation that must be addressed first to deliver impact.

How: Innovation requirements and priorities

The specific technologies, tools, processes, data, skills or system enablers that must be developed, improved or integrated to meet future industry capability needs, and the priorities for HVM Catapult.

Connected technology platforms

Highlight where coordinated effort across our domains can best strengthen, connect and accelerate the technologies that matter most to UK industry

Roadmap activity examples

Establish test beds to develop, integrate and validate novel inspection, measurement and test techniques and processes.

Demonstrated the trustworthy comparative robustness of emerging inspection, measurement and test technologies

The above 'what' items are linked and dependent – denoted by the overlapping boxes

Deployment of increased mechanization to remove variability and increase standardization linked to respective process specifications

Standardised digital weld procedures, reusable qualification libraries, harmonised standards

The above 'how' discrete items that are not linked and occur in different time horizons

IUK Strategic imperatives



Alignment with the Innovate UK vision

Each demand driver is colour-coded to align with the four imperatives of the Innovate UK materials and manufacturing vision 2050.

Innovative and digital

Businesses drive continuous and transformative innovation and create, adopt and export advanced digital technologies

Resource-efficient and regenerative

Sectors maximise circularity of materials, energy and water and aim for a net positive impact on the environment

Resilient and responsive

Mitigating risks from supply chain disruptions, national/global crises, and climate change.

Skilled and empowered

Workforces are highly skilled in executing advanced tasks and are empowered by configurable, open technology stacks

Assurance



Further details of the demand drivers, industrial capability needs and innovation requirements are available online. Follow the QR code or [click here](#).

Vision

Secure the UK as a competitive provider of safe, reliable high-value manufactured products by championing best practice and redefining traditional approaches to measurement, inspection, testing and certification. Ensure assurance is recognised as a strategic value-add activity.



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2035

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Barriers to adoption of advanced and flexible manufacturing technologies

Integrated digital manufacturing and assurance data traceability

Advancing assurance certification and regulatory pathways

Challenges for circularity remanufacture and maintenance

Assurance capabilities aligned with increasing high-value manufacturing rates and product complexity

Establish test beds to develop, integrate and validate novel inspection, measurement and test techniques and processes

Developed best practice for sharing and cyber security of certification and quality data

Integrated frameworks and maturity grids for assessment and adoption of assurance processes

Demonstration of data driven quality/fault prognosis, decision making and control

Coordinated sectorial collaboration to engage regulators and drive regulatory advancement and development of new standards

Adoption of developed new product and process assurance standards

Establish test facilities supporting the testing of emerging products and applications

Cross-sector transferable inspection, measurement and certification best practice

Acceptance of in-process practices as definitive and credible sources of inspection and measurement

Assurance skills pathways for technicians and certified professionals across all inspection, measurement and test activities

Accepted methods and frameworks to ensure single source of truth for assurance data

Advanced use of data and simulation across quality and certification activities

Simplified approaches, software and AI to address assurance challenges

Demonstrated integration of assurance requirements within MBD models

Cost/benefit/risk analysis framework for investment in inspection, measurement and test activity

Encourage adoption of secure digital sharing of assurance data among supply chains

Process certification by analysis, reducing physical testing through analysis and in-process techniques

Develop DoE programme to validate accuracy of in-process detection methods

Develop adaptive and dynamic inspection planning based on results and in-process measurement

Establish secure comms traceable assurance data throughout the full model-based engineering (MBE) workflow

Demonstrate credible consistency in detection of vision recognition systems

Assurance for maintenance, repair and overhaul/remanufacture, repurpose, reuse and recycle

Demonstrated secure external access and sharing of assurance data across external supply chain partners

Automating credible digital traceability of quality and certification data

AI developed towards accelerated certification pathways, automated decision making, inspection, measurement and test

Key

Demand drivers

Why change is needed.

Industry capability needs

What capabilities industry needs to respond to these changes.

Innovation requirements

How capabilities must develop.

Priority industry capability needs

The most critical capability gaps identified through industry consultation that must be addressed first to deliver impact.

Assurance – demand drivers

Assurance barriers to adoption of advanced and flexible manufacturing technologies

Emerging Manufacturing Technologies:

Encouraging adoption of advanced and flexible manufacturing technologies that present unique assurance challenges which must be suitably addressed and enabling future products.

Available Inspection Technology:

Identifying gaps in mature measurement technology that prevent accelerated or alternative approaches to validation activities.

Emerging Inspection Technology:

Demonstration, standardisation and best practice of new and potentially disruptive inspection and measurement technology

Integrated digital manufacturing and assurance data traceability

End-to-End Data Frameworks:

Demonstrating and encouraging advanced digital tools (Model Based Design, Model Based Enterprise, Digital Product passport) to establish connected manufacturing data flows, allowing the transfer of assurance requirements, decision-making, and collaboration.

Digital Thread for Data Traceability:

Adoption of digital thread as the means of automating and strengthening traceability, driving quality improvements, lifecycle visibility, and demonstrating assurance across manufacturing operations and supply chain.

Control Systems Integration:

Demonstrating and setting assurance requirements for integrated sensing and control systems to enable responsive data driven closed loop control in support of high-performance manufacturing.

Advancing assurance certification and regulatory pathways

Regulatory Compliance:

Evolving regulations demand rigorous assurance frameworks to deliver safe, certified products across nuclear, energy, and aerospace sectors as well as emerging new products and applications

Accelerated Certification:

Utilisation of existing and in-process data can streamline certification, reducing barriers, supporting new products, and enabling faster market entry.

Assurance Importance:

Advocating for and demonstrating the importance of investment in assurance and value of robust inspection, measurement and testing of products to industry, government and regulators.

Assurance challenges for circularity remanufacture and maintenance

Circularity Systems:

Assurance techniques to support circularity and enable efficient material reuse. Thus enhancing sustainability, and reusable material pathways across manufacturing ecosystems.

Assurance for Life Extension:

Approaches to enhance the value of lifecycle data, ensuring performance through-use and enabling re-certification of in-service legacy equipment.

Recovery and Remanufacturing

Optimised MRO strategies ensuring safety and compliance while allowing recovery of parts with retained value, extending part life, minimising MRO cycles and improving sustainability outcomes.

Assurance capabilities aligned with increasing high-value manufacturing rates and product complexity

Process Optimisation:

Using trusted data-driven optimisation enhances productivity, improves energy efficiency, reduces cost, and strengthen quality across manufacturing systems.

Cross-Functional Assurance Integration:

Alignment between engineering, production, and quality teams to communicate consistent standards across increasingly complex products.

Scalable inspection and validation systems:

Assurance processes that can keep pace with upscaling of production volume while maintaining accuracy and repeatability.



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Strategic summary

Assurance is fundamental to the credibility of the work carried out within HVM Catapult. Through advancement of in-process measurement, traceability and the exploitation of data, HVMC is helping position the UK as a global leader in the adoption and exploitation of novel assurance methods. This work supports UK manufacturers in ensuring robust product-assurance approaches, while reducing cost and development lead times.

Strategic imperatives

- Innovative and digital
- Resource efficient and regenerative
- Resilient and responsive
- Skilled and responsive



TSPG Title – Industry capability needs

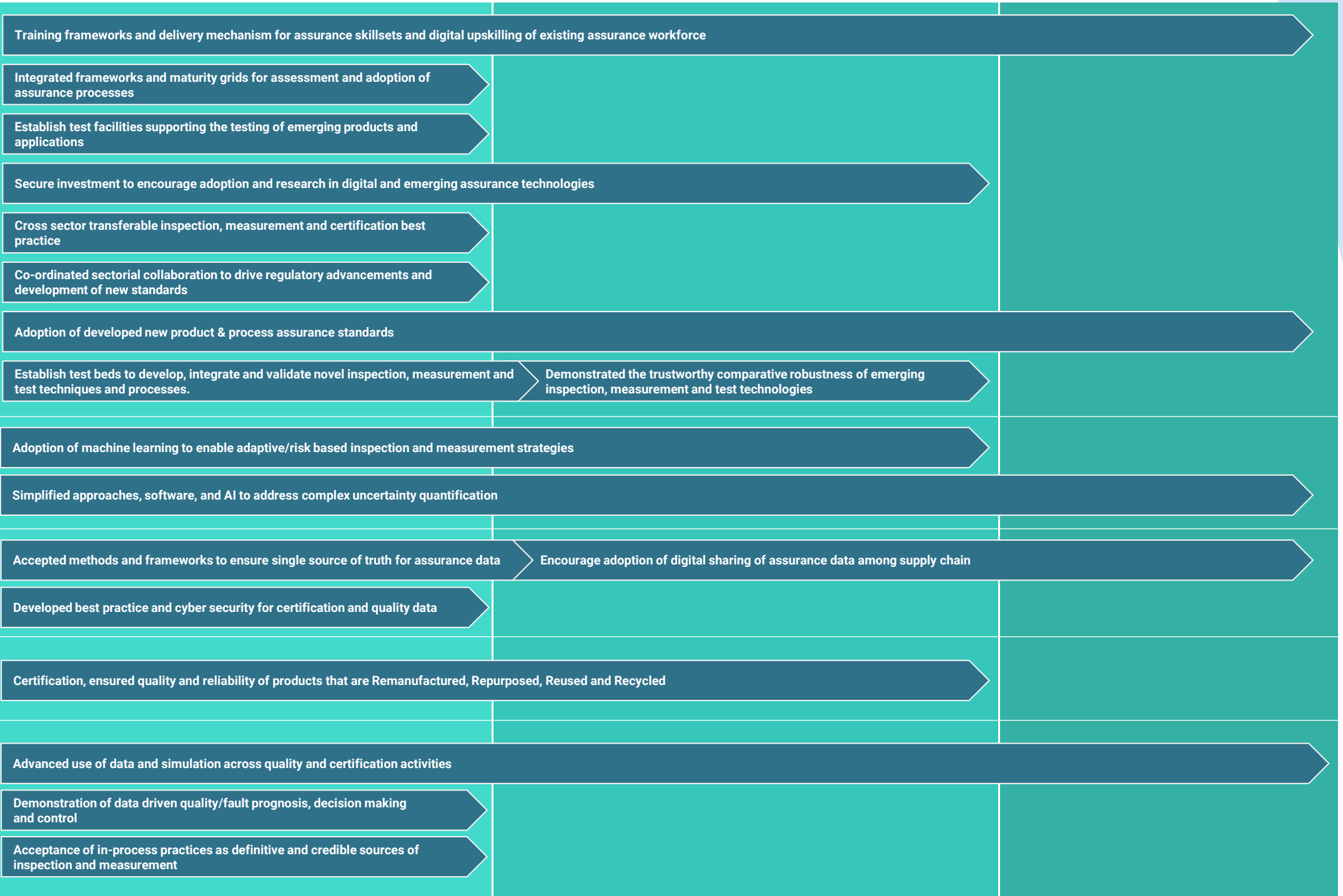
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Technology domain specific



Artificial intelligence enabled advanced manufacturing

Digital Thread

Value retention

Intelligent manufacturing assurance & regulatory engagement

TSPG Title – Innovation requirements

2026

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Technology domain specific

- Gap and maturity analysis of available and required manufacturing sensors and measurement techniques aligned to advanced assurance
- Cost/benefit/risk analysis framework for investment in inspection, measurement and test activity
- Assurance skills pathways for technicians and certified professionals across all inspection, measurement and test activities
- Enabling accelerated standards for certification of new products to meet emerging needs, such as clean energy

Artificial intelligence enabled advanced manufacturing

- Landscape AI opportunities for assurance and UK position
- Automation of fault analysis and classification of defects for triage of corrective action
- Demonstrate credible consistency in detection of vision recognition systems

- Developed AI towards accelerated certification pathways, inspection, measurement and test processes and technologies
- Automate and validate inspection pathway programming using MBD data
- Develop adaptive & dynamic inspection planning based on results and in-process measurement

Digital Thread

- Demonstrated integration of assurance requirements within MBD models
- Enabling the sharing of Assurance data among stakeholders across the product development lifecycle

- Automating credible digital traceability of quality and certification data
- Maintained digital traceability of assurance and operation data in-field for exploitation and intervention strategies
- Establish secure traceable assurance data throughout the full Model-Based Engineering (MBE) workflow
- Demonstrated secure external access and sharing of assurance data across external supply chain partners

Manufacturing with advanced materials

- Inspection, measurement and test of advanced materials

Value retention

- Assurance for Maintenance, Repair, and Overhaul / Remanufacture, Repurpose, Reuse and Recycle

Intelligent manufacturing assurance & regulatory engagement

- Demonstratable application of in-process control
- Demonstratable application of in-process Monitoring
- Adoption of robust approaches to Quality by Design within the pharmaceutical sector
- Advocating for the importance of assurance investment, research, strategy and policy

- Develop DoE programme to validate accuracy of in-process detection methods
- Process certification by analysis, reducing physical testing through analysis and in-process techniques

Automation of processes and digital integration

- Advanced integration of assurance considerations and constraints within the design process
- Automating development of SOP's for knowledge sharing of best practice and processes across inspection, measurement and test

Assurance: priority pathways

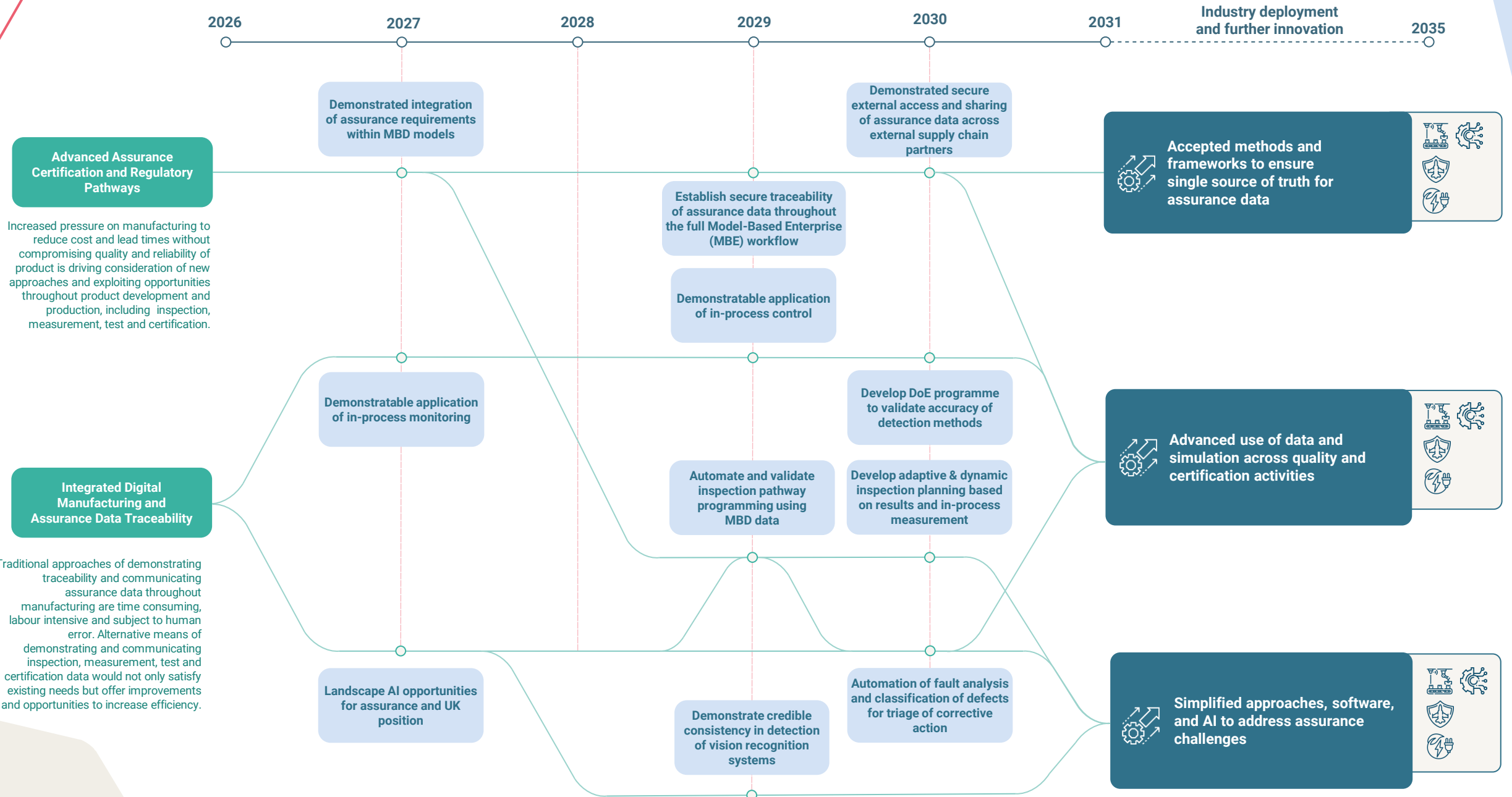


Diagram Legend

- Demand drivers**
Why change is needed
- Innovation requirements**
How capabilities must develop
- Industry capability needs**
What capabilities industry needs to respond to these challenges
- Priority industry capability needs**
The most critical capability gaps identified through industry consultation that be addressed first to deliver impact

Industrial strategy growth-driving sectors

- Foundation Industries
- Clean Energy Industries
- Digital & Technologies
- Life Sciences
- Advanced Manufacturing
- Defence