AMPI Insights Report

February 2022 – July 2024

A Strength in Places Programme, funded by UKRI

Strength in Places Fund

UK Research and Innovation

AMPI
THE ADVANCED MACHINERY & PRODUCTIVITY INSTITUTE

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Foreword

Why we needed the Advanced Machinery and Productivity Institute

In early 2021, a major UK automotive manufacturing plant in the North of England approached one of AMPI's members – a machine manufacturer – with a challenge. They wanted a machine to recover aluminium from batteries, and they specifically wanted to source if from the UK. Unfortunately no UK manufacturer made such a machine, and they ended up importing it.

This type of request is ever more common. Large manufacturers want local machinery suppliers in order to reduce sourcing risk, import delays and supply chain emissions. They want to work with local companies who can train their staff on the machine and be nearby to fix it – we heard stories during Covid of manufacturers stopping production because their European suppliers couldn't get trained engineers over to configure machines. Many also want to support their communities and ensure that local manufacturing thrives near their factories.

Yet the UK is not meeting this demand. Our advanced machinery sector is relatively small, at around £500m[1]. Although we are a top 10 producer, we are a small player compared to global giants like Germany and Japan.

But we could be a world leader, serving not just growing demand from British manufacturers but exporting quality advanced machinery to manufacturers around the world, from India to Brazil, who lack an advanced machinery industry of their own. There is a particular opportunity to build on regional strengths in advanced machinery in Greater Manchester and West Yorkshire, once again creating a manufacturing industry that is the envy of the world.

Britain has some outstanding advanced machinery companies and top researchers in universities, particularly in these regions. But whilst they are outstanding individually, they lack cohesiveness or strategic direction. They develop excellent solutions for problems they understand well. But many problems go unsolved because the UK does not have the mechanisms to direct expertise towards problems – mechanisms which include market insight, bringing the right people together and access to capital.

There is an opportunity to change this and for the UK to capture far more of the global market. We have a good foundation to build on, thanks to the UK's small but expert machinery industry. And now is the ideal time, as new untapped opportunities are emerging in areas like batteries and recycling.

These opportunities to build a world-leading industry come along once in a generation. Through AMPI – the Advanced Machinery and Productivity Institute – we aim to deliver this for the UK.

This report explores the scale of the opportunity, progress to date, next steps and our vision for the future.

Gareth Edwards

Head of Advanced Manufacturing and Materials, National Physical Laboratory (NPL)

Programme Director, AMPI

[1] https://www.bmta.co.uk/2024/01/18/advanced-machinery-is-an-essential-component-of-a-modern-economy-why-arent-we-doing-more-in-the-uk-to-develop-it/

Introduction

Advanced machinery: The economic opportunity and challenges

The UK is the world's fifth largest machinery producer, which shows we have good strengths to build on. But the machinery economies of the US, Germany and Japan are 6-8 times larger than the UK (Italy also surpasses us, albeit by a smaller margin), which shows the untapped potential. The UK imported $49.2bn[2] of machinery in 2022, $7bn more than it exported, whereas Germany exported $102bn more than it imported. Those numbers highlight both the local UK demand and the export opportunity that the UK could tap into.

Right now is a particularly opportune moment to make a bold move. On the one hand, geopolitical uncertainty leads more UK companies to look locally for suppliers. On the other, new global industries are emerging with entirely new needs that are not yet met by the big established machine makers; in green technologies such as batteries and hydrogen, advanced materials such as graphene, recycling of complex components, 3D printing and so on.

These are all areas where there is no clear world leader in machinery, but where the UK is well positioned to grasp the nettle, thanks to pockets of expertise that could – with the right guidance – be directed towards these challenges. This new generation of machinery will also be boosted by better use of digital, data and AI, an area where the UK is ahead of many of today's current advanced machinery producing countries.

PTG Holroyd HG500 grinding machine with Joe Greenwood inspecting the 510mm diameter rotor which is believed to be the largest screw compressor rotor that has ever been ground.

Furthermore, advanced machinery could be a potent driver of growth and skills in the North of England – which has long been a government priority and home to AMPI's innovation programme – which is already home to world-leading machinery producers, large manufacturers and top universities with manufacturing research programmes.

[2] https://www.ciip.group.cam.ac.uk/wp-content/uploads/2024/03UK-Innovation-Report-2024_FINAL-20.03.24.pdf, p42

How to realise the UK advanced machinery opportunity

However, delivering this will be challenging.

Developing machinery is a high cost activity, requiring capital to get started. It is also a high skilled industry; it can take 5-10 years to become competent in designing and building precision machines. There will be complex challenges to overcome along the way – electrical, control, instrumentation, quality issues – that need specialist expertise and test equipment. And to even consider such investments, machine companies need to be confident there is a use case and a market.

Many German and American machine manufacturers are better at this because they are large companies with capital reserves and a wide range of in house expertise and test equipment. Most UK companies are smaller, many around 10-50 people, and simply cannot move at the same pace or pay for expensive test rigs.

AMPI consortium members and UKRI representatives at a PTG Holroyd-hosted event. PTG Holroyd's HG500 grinding machine visible in the background.

Solving three problems would help these companies innovate and grow.

1 The first is helping them access funding. Many small companies are focused on delivery and may not be aware of the funding options out there or how to apply. Equally, government funding may not be targeted effectively because those allocating it don't know what they don't know. Facilitating a two way conversation between industry and government will improve both.

2 The second is collaboration. Machine makers are not talking to their potential manufacturing customers nearly enough, so they are not getting insight into what their buyers need. If we can get the person who knows what they want talking to the person designing the machine, we will end up with products that are more valuable to both parties. An organisation that routinely facilities these conversations would help direct innovation to the most productive places.

Furthermore, bringing together noncompetitive overlapping knowledge – of which there is lots in the UK – can cross fertilise and speed up problem solving. For example, some textile manufacturing techniques could be applied to graphene production, but it may not even occur to graphene producers to connect with such a different industry unless someone put them in a room together. A programme in Dortmund, Germany, brings together disparate engineers every month in a coding marathon event to identify machinery problems and solutions. It has been the start of many high value commercial products and unblocked many engineering challenges.

3 The third is access to expertise. A 50-person company may not have experts in robotics, control software, digital design or AI, sitting around for when they need them, nor gold standard measurement technologies with which to confirm their machines perform within tight tolerances. But from time to time they need these things to innovate and their absence becomes a roadblock. These capabilities, technologies and experts are all available through UK academia, government institutes and organisations like the NPL. These organisations are full of people who have solved similar problems and PhD students looking for interesting projects. They need to be connected to the companies who need them.

That is why we need a collaborative organisation such as AMPI. An organisation that can support on these three areas would derisk innovation for small and mid-sized companies and give them the confidence to turn more ideas into commercial products, helping them grow, boost revenue, train more apprentices and contribute more to UK plc. That in turn will create a new generation of more productive machines, which are produced quickly, cost-effectively and in the UK.

What is AMPI?

AMPI is an industry-defined initiative, launched in February 2022 with the goal of stimulating the UK's advanced machinery sector, starting with Greater Manchester and West Yorkshire.

We are a partnership between academia, industry, local government and NPL, who have come together to support advanced machinery companies to innovate to deliver the next generation of high value machinery **(see Image 1)**.

Through a combination of initiatives **(see below)**, we aim to boost innovation in machine manufacturing companies across Greater Manchester and West Yorkshire, through access to technical and commercial expertise, collaboration with end users and funding. Our founding belief is that this will lead to more commercialised advanced machinery products, generate growth from local sales and experts and create regional jobs, from apprentices to PhDs.

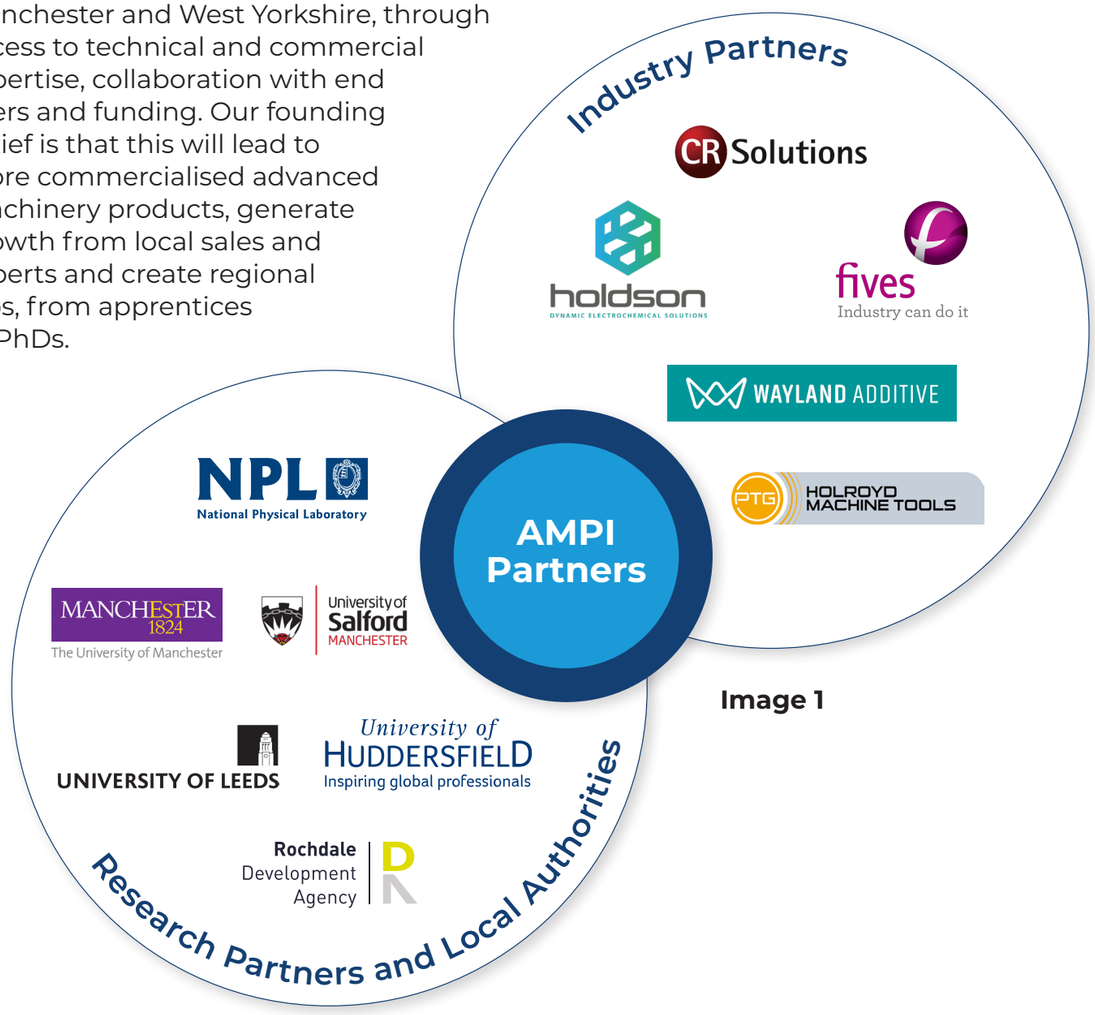


Image 1

AMPI exists thanks to £22.6m from UKRI's Strength in Places Fund (SIPF), which helps areas of the UK build on existing regional strengths in research and innovation to deliver benefits for their local economy, and the UK as a whole. This funding covers a five year programme – running February 2022 to September 2026 – to directly advance UK advanced machinery companies, whilst using the activities to learn what a sustainable future institute will look like.

Strength in Places Fund

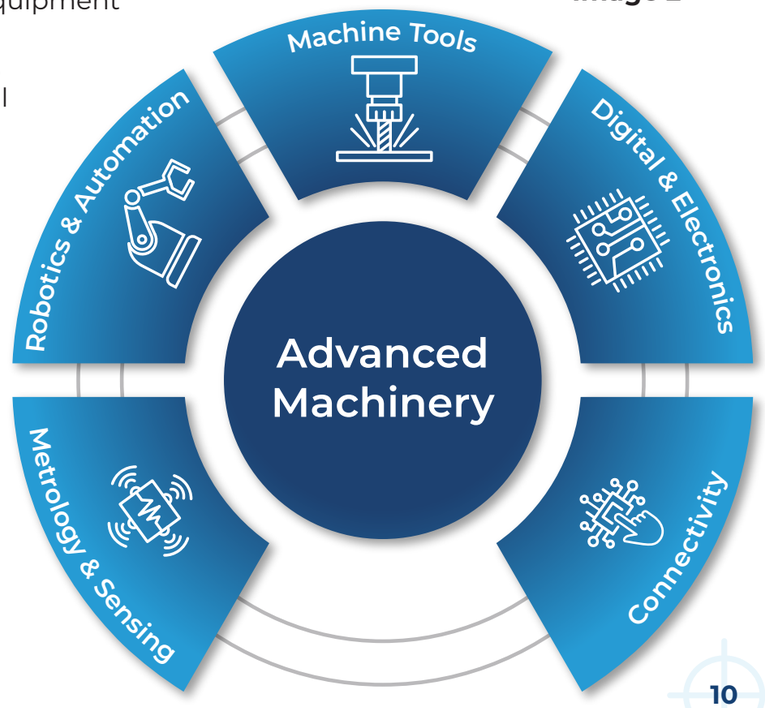
This £316 million UKRI fund helps areas of the UK build on existing strengths in research and innovation to deliver benefits to their local economy.

It aims to support innovation-led regional growth and enhance local research and innovation collaborations. AMPI – which focuses on West Yorkshire and Greater Manchester – is one of 12 funded projects around the UK.

Who is AMPI for?

AMPI primarily supports companies who are designing, developing and building advanced machinery, though in doing so we will also deliver benefits to manufacturers of advanced products. Advanced machinery refers to technologically advanced equipment for manufacturing, production and other complex operations. They are the machines that will be used to produce complex products from batteries to semiconductors to graphene. These machines incorporate innovative technologies including precision control systems, automation and advanced materials. These technologies improve efficiency, accuracy, productivity, flexibility and safety in industrial processes. AMPI categorises advanced machinery into five themes **(see Image 2)**.

Image 2



How are we doing it?

Under the current five year UKRI-funded initiative we are supporting manufacturers in three ways:

1 Access to funding

AMPI has offered several funding programmes of different levels to varying sizes of company, from transformative year long programme to develop new machines, to short term projects to unblock technical barriers.

2 Access to expertise

Our programme gives advanced machinery companies access to expertise and cutting-edge facilities outside of their organisation that enable innovation they could not otherwise have delivered.

3 Collaboration

All our funding programmes explicitly state collaboration as a key criterion. We bring together industry leading machine builders and integrators, research institutions and academia, local authorities and end users. AMPI exists to share issues, learnings, needs, discuss challenges and identify paths to solutions.

These are being delivered through a series of funded activity streams.

Industry-led research:
Six (to date) long-term (1 year+) projects to deliver next-generation machinery capability, led by an industrial partner.

Academic-led research:
11 university research projects, with an industrial champion to ensure research outputs deliver tangible value to industry.

Innovation for Machinery (I4M):
28 (to date) short-term expert consultancy projects – many of which include access to cutting-edge technology development – to help machine manufacturers solve thorny problems that hamper commercialisation.

Industry engagement:
Bringing together machine manufacturers and machine users across the region and beyond to ensure innovation is guided by end user needs.

In addition to delivering tangible benefits for companies (see 'Success stories' below), we are also evaluating the above initiatives to assess value and define what a future sustainable institution will look like. We aim to identify an optimal framework for unlocking barriers to innovation and growth, which will form the basis of a roadmap for a self-sustaining AMPI institute once the funded programme ends.

Why we think it will work

AMPI is the first of its kind in this sector, but it draws on lessons from successful programmes, such as **Made Smarter**, which supports UK manufacturers to innovate by adopting new digital technologies, and the **EPSRC Future Manufacturing Hubs**, which brings together researchers to commercialise early stage research in emerging areas, ranging from composites to targeted medicines.

AMPI successes so far

AMPI in numbers
(February 2022 – July 2024)

250+
businesses engaged

50+
formal collaborations facilitated

Advanced Machinery Technology Roadmap

AMPI
THE ADVANCED MACHINERY & PRODUCTIVITY INSTITUTE

Strength in Places Fund

UK Research and Innovation

50+
research projects commissioned

30+
direct employment opportunities created

£8m+
to businesses for industry-led projects

30+
companies supported through funding

Success stories

How we've supported UK machinery companies

HOLTEX ENGINEERING SOLUTIONS

The impact of accessing funding support through Innovation for Machinery (I4M)

The problem

Holtex is an engineering company based in West Yorkshire, committed to supporting the maintenance and service of machinery and equipment. A large automotive company wanted to improve fuel efficiency in engines and hydrogen fuel systems and approached Holtex to take advantage of Electrochemical machining (ECM) – a machining process that can change the surface of any conductive material, no matter its properties. They wanted to use ECM to improve internal geometries in aluminium parts, which required complex modelling beyond Holtex's current capabilities.

Ti6Al4V part polished with electroform™ – before measurement 8.1 um Sa, after post-processing 1.19um in 20-minute cycle time.

The solution: A multiphysics model

The project – a collaboration between Holtex and the University of Huddersfield – used computational fluid dynamics (CFD) to create a multiphysics model of the ECM process. The goal was to test the model's accuracy and find general trends for setting up the ECM process. The University of Huddersfield ran digital simulations to optimise the ECM process. This allowed Holtex to adjust its test settings, which were then used in real-world applications at the customer's site.

How AMPI helped

AMPI provided support for this project through its I4M funding programme, which facilitated rapid deployment of academic resources and enabled a smooth integration of academic expertise and practical application. This collaboration enabled Holtex to access advanced software and expertise they lacked internally. This resulted in a significant reduction in development time and costs – **instead of spending six to nine months recruiting specialised skills and acquiring necessary software, Holtex could focus on immediate application and testing.**

The multiphysics ECM model presents substantial opportunities for time and cost savings. Once fully optimised, the model will serve as a digital twin, replacing the need for continuous experimental trials. This advancement will allow for precise assessment of changes in reaction rates and anodic dissolution, enhancing the efficiency and accuracy of the ECM process. Future collaborations with AMPI and its academic network could further refine and expand the capabilities of the ECM process.

Holdson's advanced AI powered software intelligently polishes parts, tailoring fluid flow based on each component's unique geometry with optimised CFD mapping, resulting in smooth, precise and uniform surface finishes.

> This project allowed rapid deployment of academic support without hurdles, and it's helped bolster follow-on commitment.
>
> **Aaron Holt, CEO, Holtex.**

Success stories

MANCHESTER 1824
The University of Manchester

UNIVERSITY OF LEEDS

Connecting soft robotics and manufacturing automation expertise to develop new robot manufacturing capabilities

The problem

The University of Manchester and the University of Leeds were working independently on robotics, 3D printing and advanced manufacturing projects, and both shared a vision to develop next-generation manufacturing technologies in these areas. There was obvious complementary experience that could be deployed towards solving complex machinery problems. But without a mechanism to bring them together, there was no route to realising this benefit, or even defining what was possible.

The solution

When AMPI began, the two Universities, as founding partners, took part in collaborative forums set up to explore industry needs and solutions. Those brought together Robert Kay and Andrew Weightman, respectively professors of Advanced Manufacturing at Leeds and Medical Mechatronics at Manchester. “We’d never met before, despite working in similar areas”, says Kay. “But once we got together, we did a lot of brainstorming and worked out how we could link our work for the benefit of UK machinery.”

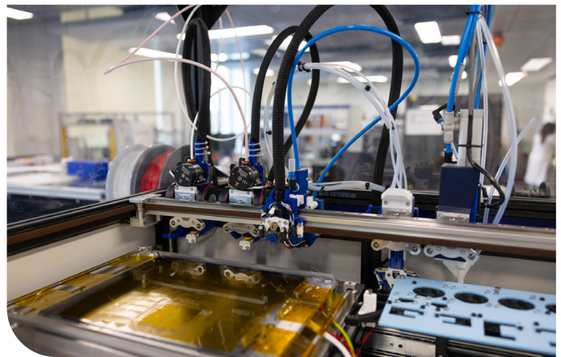
This led to a project that merged Manchester’s expertise in soft robotics with Leeds’ capabilities in 3D printing and automated assembly. The collaboration has since delivered a novel machine concept capable of integrating additive and subtractive manufacturing techniques – the Automated Robot Manufacturing System (ARMS) – thanks to innovative tool head changes, multi-material manufacturing capabilities and agile pick and place grippers.

Prof Robert Kay explaining how intricate components are produced by the ARMS.

How AMPI helped

AMPI provided the framework for collaboration between the universities and the Technology Forums hosted by AMPI facilitated knowledge sharing between academia and industry throughout the project. This created a collaborative ecosystem that encouraged cross-learning. Without AMPI it is unlikely that the two universities would have connected and collaborated in such depth. It is notoriously difficult for universities to work together on developing advanced machinery due to the competitive nature of R&D grant funding and the rules around funding allocation. “AMPI has been essential in breaking down silos and fostering collaboration between our institutions” says Kay. “By linking our research efforts, we’ve unlocked new possibilities for the future of UK manufacturing.”

“AMPI was also vital in directly funding the project” he adds. “It’s very hard to get funding for research around building machinery. It’s capital intensive and at the moment the government want to fund things like AI. So AMPI is quite unique in being able to make these things happen”. AMPI’s autonomy allows it to direct its funding towards collaborations that will deliver the most impact, rather than based on one-size-fits-all assessment metrics.



The ARMS leverages cutting-edge automation and precision manufacturing to create complex, high-performance parts.

Success stories

Accessing measurement expertise to get a business-transforming machine to market quickly

The problem

Fives Landis is a leading machine tool manufacturer with a big market amongst customers who make combustion engine components. As the world has shifted towards EVs, they have recognised their business needed to adapt.

"The big challenge for us was to actually remain in business, and that meant using our skills to build machines for different customers" says Derry Falkner, Manager Electronic Systems Engineering at Fives Landis. "One of the largest opportunities we identified was in bearings, which is a huge industry worldwide".

This led to Fives Landis developing a whole new machine. But to succeed they needed cutting-edge calibration techniques and advanced machine tool configurations for their new machine, requiring expertise to enhance the company's capabilities.

The solution

AMPI facilitated a collaboration between Fives Landis and Andrew Longstaff, Professor of Machine Tool Metrology, at the University of Huddersfield, whose team specialise in precision measurement and error compensation for machinery.

"Andrew was there at the initial AMPI meeting," says Falkner, "and it all started from there." That led to an AMPI project that gave Fives Landis access to academic expertise and research capabilities that were instrumental in refining its Computer Numerical Control (CNC) software and calibration processes.

The University of Huddersfield modelled Fives Landis' new design in their machine simulator, isolating potential error sources and process sensitivities. By running a series of virtual "what if" scenarios, they helped Fives Landis gain a clear understanding of the relationship between machine errors and component quality, which they could then resolve – improving the machine's accuracy and reducing development time.

The software and a symbiotic relationship

Through a mutually beneficial collaboration facilitated by the AMPI consortium, Fives Landis and the University of Huddersfield have forged a strong working relationship. Fives Landis constructed and supplied a CNC control cabinet for the University's test rig, granting researchers full access to the control programming environment. This access empowered the University to develop targeted solutions for their research projects, with a focus on collecting high-speed, deterministic data directly from the control.

The insights gained from the University's work, including data shared with the University of Manchester, directly informed Fives Landis' development of a full digital twin for their bearing machine, integrated with the Fives Landis CNC6400 control. This collaboration allowed Fives Landis to prioritise features based on real-world research needs.

Fives Landis' grind display with proprietary CNC control.

How AMPI helped

"AMPI brought together academia and different companies and gave us the opportunity to build relationships," says Falkner. "The whole project reduced the time it took us to move from a new concept to a final machine. It's an example of bringing the right knowledge in at the right time." The institute also provided critical funding, enabling Fives Landis to invest in the development of its new machines for the bearing industry. As a result, the new machine has now been developed and commissioned and a major company is excited about getting it on site

The project has also been good for Huddersfield. "We have all this expertise in mechanics, electronics and control software" says Longstaff. "But if you try as academics to just dream up something that won't eventually solve a problem, it doesn't really mean much. Working with people like Derry lets us use our expertise to solve tangible problems and create real impact."

Delivering industrial research

A major strand of AMPI is its six flagship industrial projects, designed to support UK companies to deliver next-generation machinery capability.

1

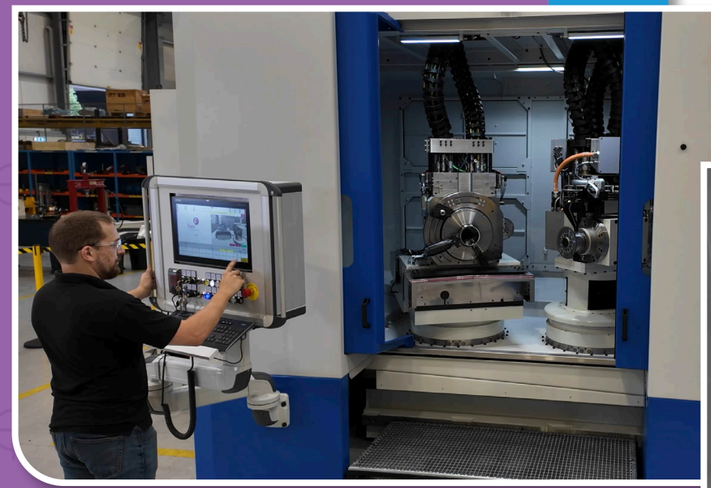
Large helical grinding machine

Who: PTG HOLROYD

What: A helical grinding machine with multiple high-precision grinding configurations.

Why: Fast, flexible, accurate production of high-precision components, such as screw compressor rotors widely used in automotive, aerospace and industrial machinery.

510mm diameter compressor rotor inside the PTG Holroyd HG500 helical grinding machine.



TTG3000 with Matthew Abbey, Manager of Advance Testing and Applications at Fives Landis.

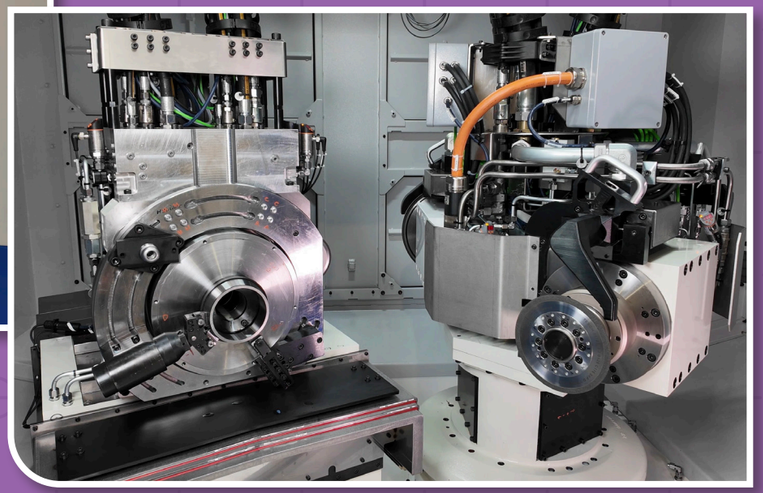
2

Twin turret grinding machine

Who: FIVES LANDIS

What: A Twin Turret Grinding Machine with software that allows it to adapt to different production parameters in real-time.

Why: Flexible, automated grinding of high-value, low-volume bearing rings typically for aerospace applications and low-value, high-volume bearing rings, which are in high demand for the electric vehicle and green energy industries.



The machine's twin rotary turrets. Left turret: Component work-head and tooling. Right turret: Grinding spindles.

3

Integrated free-form additive manufacturing (AM) machine

Who: WAYLAND ADDITIVE

What: A machine using advanced electron-beam technology to rapidly produce personalised maxillofacial implants with complex shapes.

Why: To reduce production of implants such as bone plates, screws, and dental implants from six months to two days.

Wayland Additive Calibur3.

Delivering industrial research

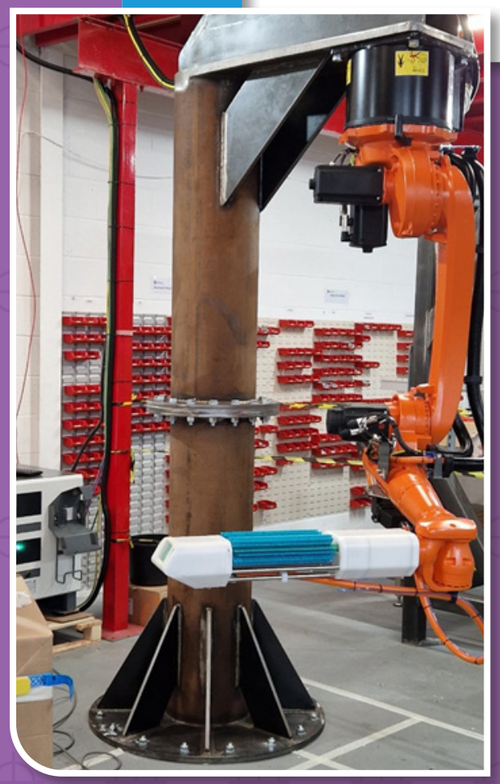
4

Sanicleanse™ advanced dairy machine

Who: CR SOLUTIONS

What: Automated preparation and sterilisation of cow teats for the dairy industry, using AI powered robotic arms to locate and clean the teats without harming the animal

Why: To reduce manual labour, enhance animal welfare, and optimise milking efficiency, contributing to a more sustainable and productive dairy industry.



The CR Solutions Sanicleanse™ end effector.

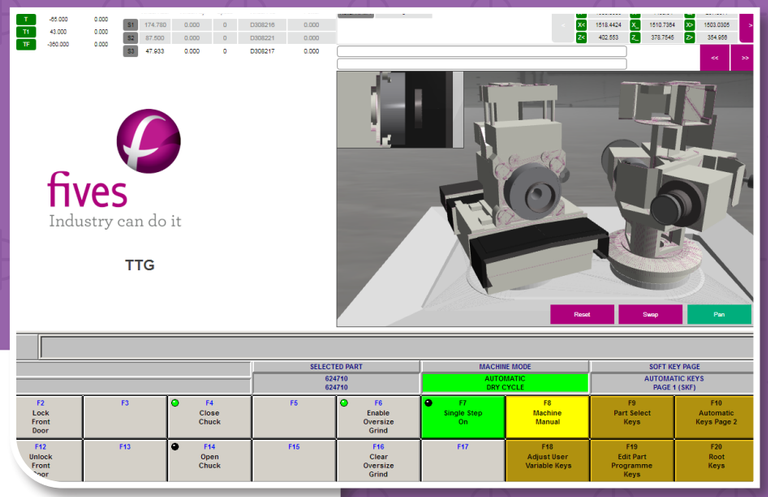
5

Open source CNC control

Who: FIVES LANDIS

What: An open-source computer numerical controller (CNC) that allows users to implement their own software code directly into any precision manufacturing machine.

Why: Enabling industry and academia to easily design customised control software, lowering barriers for small-to-medium enterprises (SMEs) to adapt machinery to their needs.



Fives Landis CNC6400 control including full integrated digital twin.

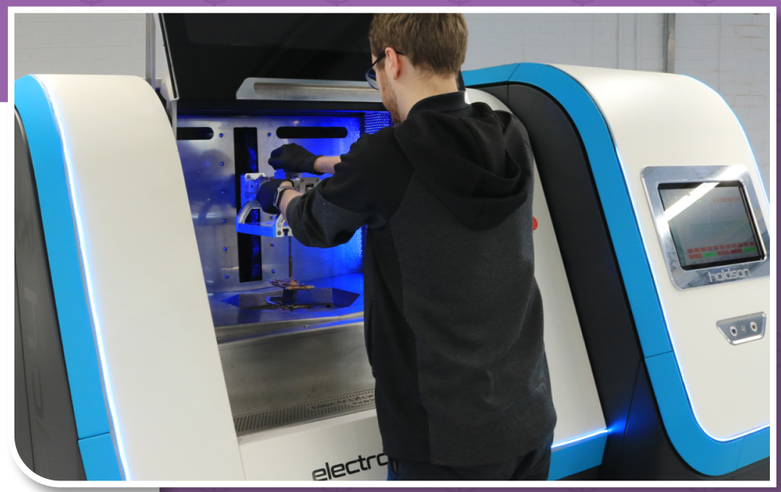
6

Electroform™ electrochemical polishing machine

Who: HOLDSON

What: A proprietary electrochemical process for precise surface material removal with the capability to process multiple parts simultaneously

Why: Quickly altering surface properties of materials to deliver high-quality finishes without compromising the component's overall structure.



Henry Bramwell operating Holdson's electroform machine, which is up to six times faster than other post-processing methods and systems.

Capabilities and expertise across our innovation network

AMPI is essentially a distributed network of world-class science and engineering capabilities with the ability to quickly connect companies to the expertise and facilities that can solve their problems. Not only do we find the right people, we minimise the admin of collaborating by setting up projects and partnerships which can be administratively burdensome for small companies who don't know how to navigate the red tape of formal collaborations.

This section summarises these cutting-edge capabilities and provides examples of industry-championed research collaborations that are already underway.

The National Physical Laboratory (NPL):

Strength: On-machine metrology and in-process monitoring.

Sample AMPI project: Developing tests to validate metrology systems used in large volume application, improving the precision of machinery such as robotic systems used to align large parts during aircraft manufacture.

University of Huddersfield:

Strength: Metrology and simulation for intelligent machines and frameworks for machine interoperability.

Sample AMPI project: Physics-based simulations that predict outcomes of a new machine design or reconfiguration, enabling machine developers to make design optimisations before committing to physical changes.

University of Leeds:

Strength: Hybrid manufacturing, novel robotic systems, and autonomous fabrication.

Sample AMPI project: The Automated Robot Manufacturing System (ARMS), combining precision robotics with additive manufacturing and automated assembly using multiple tool heads that will enable integrated manufacturing and assembly of small machines.

University of Manchester:

Strength: Robotics, including control systems for human-robot interaction (HRI); and materials engineering including lightweighting for machinery.

Sample AMPI project: A robotic arm for handling hazardous materials in a glovebox, enabling precise and safe manipulation of materials without operator risk. Robotic arm with near-infinite degrees of freedom is visible on page 25.

University of Salford:

Strength: Modular and adaptable robotics, and low-cost robotic control systems.

Sample AMPI project: A control system for modular robots, that will enable companies to easily customise off-the-shelf robots to suit their needs.

External engagement

A key element of success for an enduring institute like AMPI is external engagement – ensuring that those who can benefit from our work understand what we do. To that end, we have an ongoing programme of events and communications.

SEPTEMBER 2021

AMPI launch

AMPI was launched at the 41st MATADOR Conference on 15-17 September 2021, held on The University of Manchester campus. AMPI used this as an opportunity to publicly outline our goals, what the funding means for the local area and how we will support industry and academia to develop the next generation of machines.

AMPI has also communicated its plans via the media, most notably in Trade Journal **The Manufacturer**, which has run articles on AMPI's calls for investment and R&D to boost UK's advanced machinery sector, and how collaboration can drive growth for the UK's advanced machinery manufacturing SMEs.

FEBRUARY 2023

Endorsement from the top

Of particular note was an event in February 2023, where AMPI was credited as a catalyst for high-quality advanced manufacturing innovation and jobs by the Mayors of Greater Manchester, Andy Burnham and the Mayor of West Yorkshire, Tracy Brabin, as they outlined their vision for revitalising the North's industrial landscape.

> Burnham said:
>
> This is the best opportunity we will get to reindustrialise the North of England, but in a good way, a clean way that brings prosperity in the future. If we're going to rise to that challenge, it will require us to innovate, to bring forward new materials and ways of making things. It will be built by a network of organisations and institutions like AMPI that are ready to go faster – that's how the North of England rises again.

JUNE 2024

AMPI's first Technology Forum

AMPI's academic network is only valuable if it can apply its expertise to solving problems. To this end, AMPI's first Technology Forum was held on June 19 2024, at the University of Leeds, bringing together 50 participants from companies and universities across the consortium.

The event helped companies understand the breadth and depth of academic capabilities across the network, share ideas, identify problems and start conversations on how to solve them.

Roadmapping the future

A key part of achieving our goals of advancing the UK advanced machinery sector is helping set a productive direction for the future, one which helps focus resources and expertise on the solutions most likely to generate value. With this goal in mind, AMPI has developed a technology roadmap – in consultation with 60+ industrial and academic organisations – which identifies market drivers and future machinery needs.

The roadmap identified many market drivers for new machinery needs, from the emergence of new technologies in electrification, hydrogen propulsion and space, to the need for lightweight materials and recycling and material recovery at the end of a product's life. Across industries there was noted interest in additive manufacturing/3D printing and tools for producing, customising and implementing advanced materials.

There was also great demand to harness technologies such as automation, connectivity, condition monitoring, analytics and AI to improve productivity and functionality of new and existing machines. Manufacturers wanted more agile and re-configurable machines to support them as they create more customised products that require more regular updates.

Finally, our roadmap reinforced the desire by UK companies to buy local where possible, both to support local supplier ecosystems and to avoid import tariffs and uncertainties.

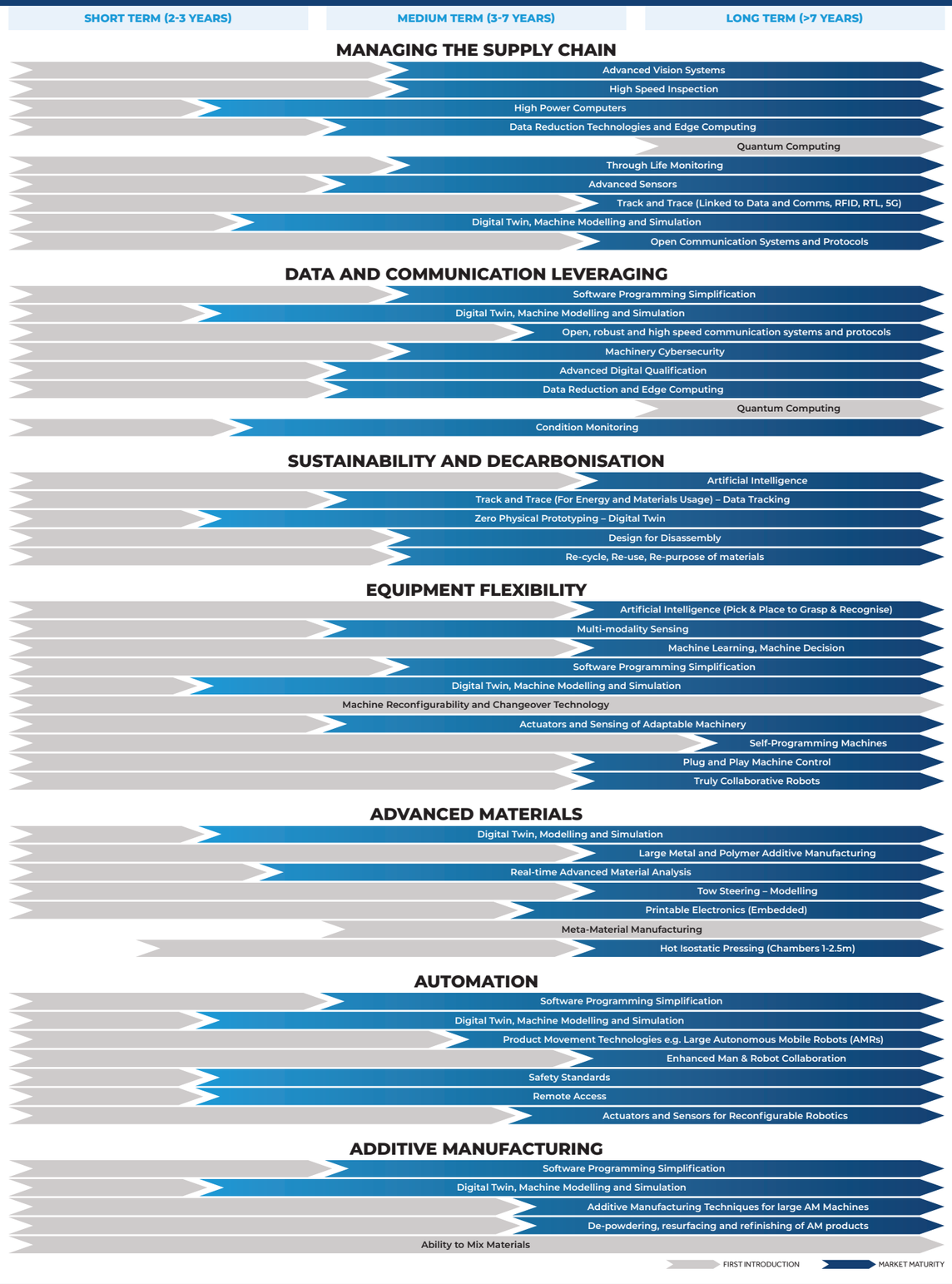
With this initial roadmap – **which can be viewed here** – we have defined the needs of UK manufacturing industries and highlighted the nature of the opportunity for the UK machinery industry and likely timescales for development across different technologies.

More still needs to be done to support UK machinery to deliver against these identified needs, and this will be an ongoing goal of AMPI. But, whilst instructive, the roadmap is neither exhaustive nor definitive. We want to continually hear from contributors across industry and academia whether they agree with these conclusions, what they think is missing and how we can help everyone move forward in the most productive directions.

Any interested parties who wish to contribute to the roadmap's evolution and implementation should contact AMPI via our website form at **ampiuk.org/roadmap** to explore opportunities to be involved.

Technology Roadmap

AMPI
THE ADVANCED MACHINERY & PRODUCTIVITY INSTITUTE



Our vision

AMPI represents a bold vision for the future of manufacturing in the UK and the growth of a world-leading advanced machinery industry, building on the strength demonstrated in Greater Manchester and West Yorkshire to deliver industrial innovation and growth across the region and beyond.

The current programme has already delivered significant outcomes in terms of innovative collaborations, job creation and funding that will undoubtedly deliver growth in the region.

But that is just the start. Our vision extends to building a lasting and self-sustaining Advanced Machinery Institute that will deliver ever greater returns to the UK economy by permanently supporting the advanced machinery sector, at scale.

The Department for Science, Innovation and Technology (DSIT) has set out a priority to put the UK at the top of the table in science and technology. Yet across the UK, the default is often to procure manufacturing technologies from overseas rather than to develop and exploit home-grown technologies. Despite the major disruptions in manufacturing demands, such as from global net zero transitions, there is no UK research or innovation Institute specifically aligned to the needs of the advanced machinery sector, as there is for many of our global competitors.

The Advanced Machinery Institute will be an industry-defined response to delivering against these opportunities.

The institute will support companies who are designing, developing and building advanced machinery. This will bolster commercialisation of new machinery products, growth from domestic sales and exports, supply chains resilience and the creation of high-skilled jobs, as well as benefitting to the wider manufacturing industry through access to new and better technology.

The Institute focus will be on three areas of added value:

- Providing engagement and **collaboration mechanisms for industry to access UK machinery capabilities and expertise, connecting machinery companies with researchers and service providers** who can solve problems and advance their technologies. This will create a virtuous circle where the UK advanced machinery industry is continually innovating to meet real industry needs.
- Support **access to innovation funding** for advanced machinery development.
- Developing a **joined up ecosystem**, a community focused on advanced machinery innovation, and acting as a thought leader for the sector, developing machinery strategies and roadmaps to guide future investment.

AMPI is about harnessing innovation, collaboration and strategic foresight to reinvigorate an industry that is crucial to the nation's economic resilience and global competitiveness. It is uniquely poised to transform the UK into a more competitive environment for machinery development, creating opportunities across the country and beyond, energising communities and delivering long-term economic growth.

This report was compiled by NPL, who lead the AMPI SIPF Programme.

NPL
National Physical Laboratory

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