Artificial Intelligence:
In Design and Manufacturing

Sophie Adams-Foster

2024 Churchill Fellow

the CHURCHILL fellowship

Acknowledgements
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In-person conversations in Germany, Netherlands, Sweden, Vietnam as well as in the UK were backed up by many(!) online calls with additional contributions from the US, Singapore and Finland.

Conversations spanned industries from, Health Tech, Textiles, Sustainability, Academia Consultancies, and Manufacturing. I spoke with Product Designers, IT Specialists, Data Transformation Engineers, Design Agency Owners, various ‘Heads / Leads of’ and beyond.

I have intentionally chosen not to list everyone I spoke to. First, every conversation was grounded in openness and candour. Some touched on products and event that could make companies or individuals recognisable. Industry can be quite a small place, I don’t want to put them in a difficult position. Secondly, in the age of AI where “scrape first, ask forgiveness later” is an uncomfortable reality I want to protect the trust of those who contributed.

Anonymous thanks also goes to the countless makers and doers who I have worked alongside over the years. They have helped me understand the design industry and the many ways things are made.

Finally, my deepest gratitude to my friends and family, especially Mark. For creating the space and time for me to follow my passion, and for believing in me.

About the Author
Sophie is a strategic design leader working in the UK Industrial Design and Engineering Industry, helping businesses design, develop and launch products to market. Having worked in a number of businesses across electronics, prototyping and design she has collaborated with inventors, SMEs and large organisations on a variety of products and technologies.

Authors Note: The moment we are in right now
I have no doubt that within a matter of months, this research (published in the Autumn of 2025) will feel out of date. I would not be surprised if the bubble on AI ‘bursts’ by the end of the year.

The world of Artificial Intelligence (AI) is moving spectacularly fast at this moment in time, with breakthroughs, mergers, and controversies unfolding daily. The pace is both exhilarating and disorientating.

Industrial espionage is a very real thing. When I began this Fellowship, many doors were wide open and plenty of people were eager to share their thoughts. However, the nature of my research and the sensitivity of competitive information, combined with the geopolitical shifts, meant that as the months unfolded some doors began to close. The result is somewhat of a jigsaw puzzle, rather than a straight line, but I think that’s what makes it a truer reflection of the world today.

This report may age quickly, but the deeper questions of meaning, value, and trust in the things we surround ourselves with will remain long after today’s technologies have either taken hold or faded away.

Contents

Photography: Sophie Adams-Foster

All Icons: 'Hand holding power cable', 'Hand flip switch', 'Hand holding money', 'Hand with Sands', 'Hand with measurement tape', 'Typing on Keyboard' by Gan Khoon Lay, from thenounproject.com CC BY 3.0

Definitions

Definitions, the context of product design.

Artificial Intelligence (AI)
The ability of computer systems to perform tasks normally requiring human intelligence, such as learning, reasoning, planning, and decision-making, by processing large amounts of data and adapting to new information.

Machine Learning (ML)
A type of AI that learns from data and improves over time without following instructions by using algorithms and statistical models to analyse patterns in data.
For example, analysing historical product failures to suggest stronger component designs, or learning from consumer feedback to refine future products.

Artificial Narrow Intelligence (ANI)
Also known as weak AI, refers to AI systems designed to perform specific, limited tasks within a predefined scope, rather than having broad, human-like intelligence.
For example: CAD-integrated AI that optimises the shape of a part for strength-to-weight ratio, or software that generates ergonomic chair variations.

Generative AI (broadly where we are today)
Specialised AI that creates new content based on large data sets and algorithms. For example: Systems that generate multiple product concepts like MidJourney, or ChatGPT-4 step-by-step manufacturing instructions.

General Intelligence (AGI) (second wave of future technologies)
A theoretical form of AI with human-like adaptability, able to learn and adapt across domains. For example: An AGI could design a product, develop the business plan, and oversee factory automation without retraining.

Agentic AI and AI Agents
Agentic AI is the system-level capability that orchestrates and manages multiple individual AI agents to accomplish broader, more complex goals with minimal human input. For example, Agenetic AI can generates a product design, sources materials from suppliers, and book prototype production automatically via individual agents.

Humans-in-the-Loop (HIL)
AI systems where people remain actively involved to ensure oversight and quality.
Example: A designer reviewing AI-generated prototypes before selecting the most feasible for 3D printing and further design.

‘Big Tech’ Companies
The major firms driving AI infrastructure and tools today (e.g. OpenAI, Anthropic, Microsoft, Google, Meta, NVIDIA).

Design Museum, London.

Executive Summary

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The United Kingdom has a long and distinguished history in design and manufacturing, producing products, machinery and inventions that have shaped both the economy and cultural identity.

The Industrial Revolution's use of iron, steel, and steam, vastly revolutionised not only what was made, but how it was made. It led to 20th-century icons such as Land Rover car, Rolls-Royce aircraft engines, radar technology, television, the Russell Hobbs kettle to Dr Martens boots. The UK has combined creativity, engineering skill with craftsmanship to create products recognised worldwide.

This foundation however has been steadily eroded through global competition, outsourcing production, rising material costs and inconsistent government support over many decades. Pressures in more recent years from COVID-19, the Ukraine war, energy price increases and importation taxes through Trump Tariffs has intensified disruption. Now Artificial Intelligence (AI) has emerged as a powerful new force and the industry faces profound challenges.

While AI has existed since the 1950s, the public release of Open AI's ChatGPT in 2022 triggered an immense wave of interest, investment, and experimentation. Much of the global conversation has centred on software and digital industries, with concerns around job displacement, environmental destruction, ownership and centralised power to a very small number of corporations.

For the UK's small and medium-sized enterprises (SMEs) in the design and manufacturing industry the challenge is not only to respond and keep pace with the opportunities the technology offers, but to also understand the implications of this technology on the physical world of products, factories and supply chains.

AI has quickly found its way into product development life cycles, from generative design image creation and simulation in CAD systems, to predictive maintenance in factories, AI-optimised supply chains and embedded intelligence in final consumer goods. These developments are reshaping workflows, altering decision-making, business models and redefining the skills required in the sector.

Whilst the UK Government continues to deliberate about which governance frameworks to align itself to whilst courting some of the world's most dominant tech companies, European countries (such as Germany, Netherlands and Sweden) confidently push forward with the EU AI Act in line with their own strategies.

Other countries, such as Vietnam are seeing a boom in businesses establishing their production lines there and adopting AI in flexible and forward-thinking ways, making it a highly desirable location to overseas businesses.

From car manufacturing, construction, housing, automotive, consumer and medical businesses, governments are shaping industrial strategies and actively seeking AI opportunities.

This research looks outwardly to those examples, and inward to the UK SME context:

- What are the barriers to UK SMEs adopting AI?
- How UK SMEs can adopt and adapt to emerging AI technologies?
- What policy and funding strategies that could support successful integration?
- Identifying where AI is making the most meaningful impact in product development and manufacturing to ensure ethical and responsible integration.

This report draws on international case studies and UK industry perspectives to suggest practical actions for policymakers on how to support design and manufacturing SMEs in meaningful, ground-level ways. At the same time, it seeks to offer manufacturers and stakeholders practical direction for navigating AI in product development.

Key Findings

Economic pressures are undermining progress. Rising energy costs, unstable sales pipelines, lead to hiring freezes mean SMEs cannot invest in skills and equipment.Legacy machinery, software and infrastructure also holds businesses back.
SMEs lack access to clean, **domain-specific data-sets**; regional hubs could provide shared, affordable infrastructure that isn't tied to 'Big Tech', securing IP, enabling experimentation and responsible integration in to business operations.
Regulation is complex and fragmented. Clearer guidance and sector-specific expertise are urgently needed to help businesses navigate evolving AI laws, such as the EU AI Act.
Without national **reskilling schemes** like Singapore's CCPs, workers risk being left behind especially those mid-career. Senior leadership teams are in 'reactive mode' and often adopting AI through a bottom up approach, rather than strategically, **data literacy training** for all is essential.
Place more value on **creativity and authorship**. AI risks producing generic products unless cultural identity, design heritage, and human authorship are protected.

Introduction to Project

Whyis Artificial Intelligence in manufacturing and design a critical issue for the UK now?

Reference: Office for National Statistics (as of 2025)

The UK manufacturing sector, employing over 2.5 million people, contributes more than £224 billion to the economy annually. Equally the Creative Industries contributes £124 billion and employs 2.4 million people. These two industries intersect at various points in the design and manufacture of products. Of the 5.5 million SMEs in the UK, 246,245 are in the manufacturing sector.

Whilst these industries continue to pull their weight, they are under enormous pressure from global competition, supply chain fragility, and rising costs. AI has now arrived and promises new efficiency and productivity, but it also threatens an enormous shift in how products are designed, manufactured and sold.

Germany Report: www.bmftr.bund.de

NL Report: www.government.nl

Sweden Report: www.strategy.ai.se

Governments and industries around the world are moving quickly to utilise the opportunities AI poses. Germany announced a €5.5 billion national AI strategy (part of High-Tech Strategy Report, 2025) to strengthen its industrial base focusing on machine vision. The Netherlands updated its existing plans announcing *'The government-wide vision on Generative AI of the Netherlands'* in 2024, alongside an announcement for a 'Groningen AI Factory' with an investment of €200 million as of June 2025. Sweden is leveraging its strong research infrastructure and business champions to embed AI across sectors (AI Strategy for Sweden, 2024). Further afield, Vietnam's booming manufacturing economy is attracting global players such as Samsung, Apple, and Nvidia who are relocating or expanding operations there under favourable policies and low labour costs.

Artificial Intelligence (AI) is not only confined to software and services alone: it is also shaping how physical products are imagined, developed, and made. It offers the ability for new creative ideas, faster development cycles and improved communication between suppliers. Yet, in 2023 in the UK, *'AI was adopted by only 5% of firms in the manufacturing sector'.*

The positives of any new technology also comes with downsides. It risks stripping away the cultural and material knowledge, displacing huge numbers of the workforce, substantial environmental impact through energy consumption whilst also asking a bigger question: what does design mean, who/what does it, and what value does it have in the future.

Despite the enormity of the design and manufacturing industry, I have always been struck by the extraordinary disconnect between people and the realities of how things are made, what they are made from, where they come from, and the processes that shape them.

In a world where an Amazon order can arrive within 24 hours, it is perhaps unsurprising that this knowledge has somewhat disappeared. We have built a world of convenience. In practice the reasons why products are made is often decided far away from the studio or workshop floor.

It is in high-level business meetings where conversations often circle around vision, values, and mission statements, and though they hold some weight I have found them often to be meaningless.

It is invariably the person holding the cheque book who makes the final call, not the well intentioned designer or tooling engineer on the factory floor.

How, what, where, and why = time, money, quality, and risk.

These are the invisible hands that determine the objects that surround us, their form, their function, and even their lifespan. Determined by commercial requirements, technology availability and market opportunity, these decisions are made by humans in one capacity or another.

Artificial intelligence now enters this equation not as a neutral tool, but as a force that can shift these balances. Today ANI and AGI can accelerate timelines, reduce costs, redefine quality, and redistribute risk. It promises efficiency and profit, but still requires a human in the loop to act as a collaborator.

In the future, Agentic AI could enable individual AI Agents to complete full development cycles, with little to no human collaboration. The question then becomes about clarity of purpose and 'who' or 'what' is driving those decisions. It will further reshape workflows, job roles and business models. It will also raise new ethical, economic, and creative questions.

AI could widen the existing gap between people and the knowledge of materials, processes and the businesses behind the products they use. In doing so, it risks distancing us further from the human and environmental consequences of production. The design industry is now at a pivotal moment as AI becomes more embedded in how we imagine, develop, and produce physical products.

Where this research come from?

I've worked within and alongside UK-based manufacturers, design agencies, supply chain partners and businesses for over 13 years. I have seen first-hand how changing consumer expectations; supply chains and trends influence design decisions. In more recent years I have seen data drive the research and creative development stages, and data acquisition being built into product functionality.

These observations have led me to think more deeply on the impact of AI on product design/manufacturing and the businesses that are part of the ecosystem.

Reports Available: www.gov.uk

This research has been started under a Conservative UK Government, with a new Labour UK Government led by Sir Keir Starmer in July 2024. During this research there has been a flurry of reports from the AI Opportunities Action Plan (January 2025) to The UK's Modern Industrial Strategy (June 2025) which sets out a 10-year plan focusing on eight *'high growth'* sectors. There have been plenty of others, and some like the SME Digital Adoption Taskforce (published in July 2025) have been more targeted.

Countries Chosen

Deciding which countries to visit proved to be challenging. China, Taiwan and the US were high on my list for their booming economies, topical focus on manufacture and AI, but geopolitics shifted from the outset of this research. I knew access to facilities would be tricky. I also felt that the UK is more closely aligned with its 'neighbours' historically, culturally and economically.

- **Netherlands:** A forward-thinking innovation leader in Europe, known for its open collaborative culture, high quality educational institutions and robust investment in technology and sustainability. A number of high profile and strategically important semiconductor businesses are based in the country, such as ASML and NXP.

- **Germany:** Known as a powerhouse of traditional manufacturing such as Volkswagen, Bosch, Adidas and ThyssenKrupp, with a deeply rooted and well-supported SME sector alongside vocational training. However, recent years have seen challenges in key industries, alongside slower progress in digital connectivity and AI adoption compared to other European peers.

- **Sweden:** Transparency, sustainability, and trust are embedded in both culture and governance, underpinning strong support for research, innovation, and global collaboration. Home to iconic companies like Volvo and IKEA, and global digital brands like Spotify, it continues to blend industrial and digital strengths.

- **Vietnam:** A fast-growing frontier economy with a strong “can-do” attitude. Many businesses are taking advantage of the governments favourable tax incentives and low labour costs to relocate or expand operations (China+1 strategy) to the country such as Samsung, Apple and Nvidia. Homegrown companies like car manufacturer VinFast have quickly expanded into EV cars and scooters, having been named in Time Magazine’s 2024 list of 100 Most Influential Companies.

Purpose of the Report
The report aims to examine product design and manufacture through the lens of AI as it currently exists, with an eye on the future, where it may evolve towards Agentic AI (‘integrated systems’).

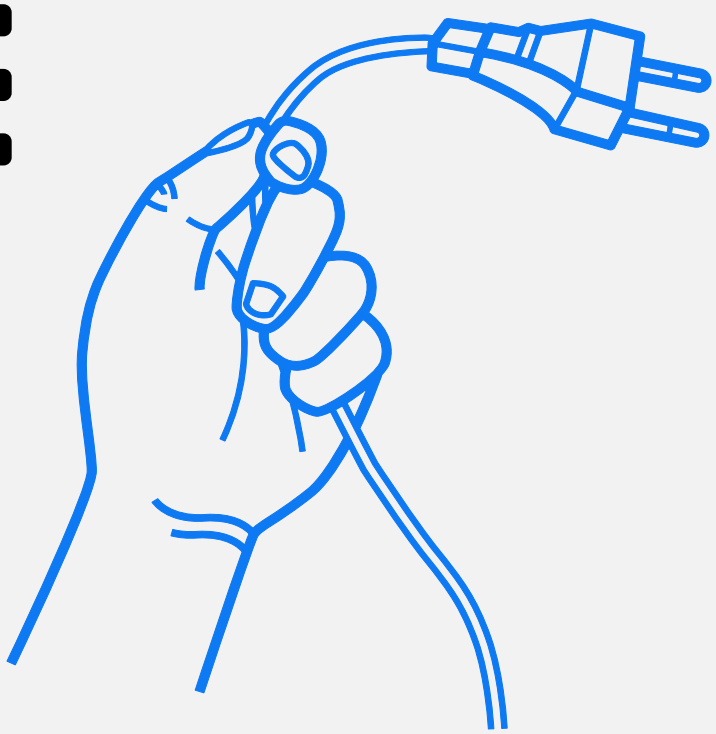
- **Identify the key barriers to AI adoption in the design and manufacturing of physical products, with a primary focus on the UK and comparative insights from overseas.**
- **Learn from traditional industry leaders in how they have managed previous industry developments, and how they are approaching current AI trends.**
- **To look at how AI will impact product design, creativity and cultural trends to understand what this means for the future of UK design and manufacturing.**

Who is this report intended for?
Ideally I’d like this report to find its way into the hands of policy makers and those working within Government institutions who have the ability to effect meaningful change for UK SMEs. I have always felt there to be a huge disconnect between government policy and the practical realities faced by businesses, particularly within the design and creative sector.

This report also aims to support UK SMEs, businesses, and other forward-thinking stakeholders as they navigate AI and plan for the future.

Approach and Methods
Drawing on previous industry experience, I carried out face-to-face interviews, factory/site visits where possible, with additional online conversations before and after meetings. I sought out as many people as possible, working at all levels within businesses for a broad view.

For privacy reasons, particularly given sensitivities around AI, I did not record any conversations.



The Assembly Line of Intelligence: Where AI plugs in

The design and manufacture of physical products follows a broadly recognisable sequence of activities. These might be overseen by a design team within a business, or made up of various contractors from different suppliers, overlapping at intersections:

Research → Ideation → Concept Development → Prototyping → Testing → Design & Engineering → Certification → Manufacture → Shipping → Distribution

AI is beginning to reshape the processes at every stage. Its opening up new creative ideas, bridging language gaps with overseas suppliers, predicating production errors with new materials and optimising shipping timelines.

Evidence of where AI is being used:

Market Research: Synthetic personas (Synthetic Users) can be generated to create targeted focus groups to conduct customer interviews to trial new ideas. AI platforms (aipalet.com) using real time data gathered from the internet can allow marketing teams to identify data and trends to guide new product ideas.

Ideation & Concept Development: Tools like Vizcom and Midjourney can produce high-quality renders from simple sketches in minutes, allowing teams to explore a wide range of aesthetic directions and materials, to present to customers for feedback.

Prototyping & Testing: AI-generated forms can be iterated at different fidelity levels, moving products "closer to the finish line" faster from visuals to 3D printing output. For example, a new kitchen appliance can be visualised, refined, and tested for colour, material, and finish options, reducing some of the costly intermediary steps.

Design & Engineering: Some platforms 'claim' to output production-ready CAD. This could streamline communication with factories and simplify complex designs, particularly when overcoming language or cultural barriers in overseas manufacturing.

Manufacturing: On the factory floor, AI-powered robotics and sensors offer predictive maintenance to help improve efficiency, whilst AI chat-bots help team members fix downed machines. In shipping logistics, AI enables real-time order tracking and route optimisation, negating costly border fees.

These tools all still require a Human-in-the-Loop to help guide processes, and the completeness and usefulness of their output are often debated among designers and engineers.

Workforce Transformation & Role Evolution

Article: Institute for Public Policy Research

For some designers and engineers AI tools are not replacing their role entirely, but they are beginning to act as "co-pilots", helping them move through workflows faster, allowing for more work to be delivered in the same time frame.

One Freelancer I spoke to described a workflow that moves from hand sketch → multiple concept sketches → AI render → modifications → Photoshop touch-up → Midjourney and ChatGPT for animations. Their workflow had sped up so much that they were now undertaking projects for multiple customers at any one time.

Other businesses are seeing team re-structures. A software engineer I spoke to commented that [we have gone from] *'ten individual employees to four engineers plus an AI co-pilot now.'* On a busy manufacturing line, a manager can now oversee the production level of an entire assembly line, troubleshooting machinery breakdowns in real time with the help of an AI-chat bot, faster and with fewer team members.

The Institute for Public Policy Research: Transformed by AI

Job displacement is a huge concern. Estimates vary wildly, but a report by The Institute for Public Policy Research (IPPR) in 2024, suggested that up to 8 million jobs could be at risk in the UK alone (across all industries). Where there is job losses, job creation is also anticipated. A senior leader in a Vietnamese production factory who is already embedding AI platform into the business told me: *"I will need more people with specialist knowledge, because when the machine goes wrong, someone has to solve it."*

Singapore CCPs Reference: www.wsg.gov.uk

Singapore is taking a proactive approach through its Career Conversion Programmes (CCPs) which launched in 2020 to re-skill mid-career workers into in-demand roles across 30 sectors**.** Providing up to 90% salary support this lowers the risk for employers in experimenting with new technologies and helps workers transition into new industries.

The UK has no comparable scheme. Training initiatives for AI are fragmented and primarily target students/graduates through the new 'TechFirst' Initiative scheme. These may be of benefit in the long term, but it does little for mid-career individuals right now.

Press release: gov.uk

Under this wider umbrella of the 'TechFirst' Initiative (June 2025), a new government-industry partnership aims to train 7.5million workers in *'essential skills to use AI by 2030'*. Partners include Google, NVIDIA, Amazon and Microsoft who will be creating and sharing 'high-quality' training material where *'training will focus on enabling workers to use and interact with AI systems such as chatbots and large language models free of charge'.*

The reliance on tech giants to deliver "free" training is concerning. While the training may expand general access and knowledge, it risks embedding UK industries deeper into proprietary platforms, reinforcing dependency, especially if the training is not sector specific.

For UK SMEs, this leaves a critical gap. The workers who most need support to adapt are experienced staff embedded in design studios and factories and they have no clear pathway to transition. A UK adaptation of Singapore's CCP, tailored to manufacturing and design, could provide continuity for workers, reduce employer risk, and accelerate meaningful AI adoption. Without such measures the UK risks developing AI literacy in theory whilst falling behind in practice.

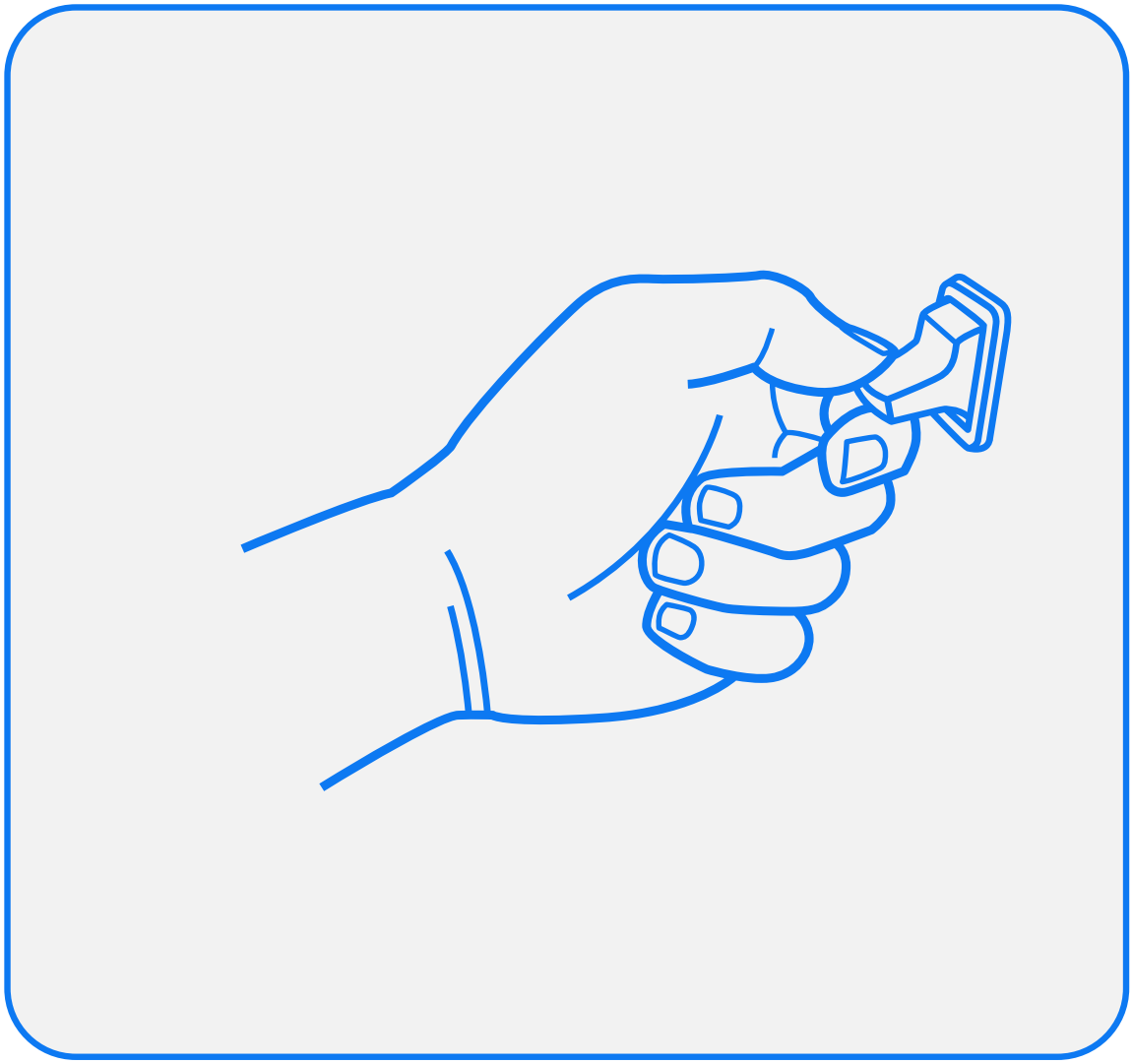
Learning for the UK

AI is not yet an autonomous assembly line. I found a general consensus that tools are mostly being experimented with by individuals, in their own roles, in their own time, rather clearly through a core business strategy approach. Government strategies such as the AI Opportunities Action Plan and Industrial Strategy point in the right direction, but success depends on execution.

- **Upskilling/reskilling**: National training schemes for existing employees, modelled on Singapore's CCP, with cost-sharing between government and employers.
- **Business Literacy:** Offer business training for senior leadership teams centred on AI literacy and ethics to help them create clear strategies for implementation, rather than relying on employees to experiment. Many businesses are still grappling with what the technology can do for them, so clear use cases would be helpful.
- **Social Partnership:** Unions, employers, and government need to implement policies and frameworks that protect workers while enabling innovation, ensuring that AI adoption leads to job transformation, not erosion.

The Infrastructure Reality Gap:

You can’t digitise what isn’t connected.



An independent workshop owned and run by a Vietnamese family in Ho Chi Minh City.

On the edge of a Midlands industrial estate, an engineering firm has just signed off on and implemented its first AI-powered machine sensors. The Managing Director imagines it will transform production, forecasting demand, reducing energy consumption and speeding up problem fixes.

Within weeks, the model is churning out recommendations that can't be actioned because the data input isn't correct and the machines on the workshop floor aren't connected to the network properly. The CNC operator still walks across the shop floor with a USB stick to upload machine drawings.

New systems and processes take time to implement and bed in, but getting the foundations in both the technology and infrastructure is critical. AI doesn't scale efficiency, it scales chaos when reliable connectivity, clean data, and interoperable machinery is missing.

The Infrastructure Reality Gap
In Industrial Design you have to work with very real materials, machinery and processes. AI offers improved efficiency and profitability, but you can't digitise what isn't connected. In conversations across the UK and in Europe, a pattern emerged:

- **Lack of connectivity**: Some workshops still have little/no WIFI, meaning AI-enabled machines or sensors can't operate in real time.
- **Patchwork systems:** Legacy machines run on proprietary software that doesn't 'speak' to new tools/sensors. Businesses are often limited by choice or tied to subscription models.
- **'Analogue' Machinery:** Expensive machinery worth hundreds of thousands on a busy production line is not easily replaced.
- ***'Boxes in the attic'*:** Information is scattered across Excel, Word, emails, old databases, and even handwritten notes. It's not formatted in a way that is useful.
- **Business/industry specific AI tools:** As demonstrated with ChatGPT, models are trained on generic data and the outputs need to be checked.
- **Solo pursuit:** When suitable tools are identified, it is often left to one or two individuals to experiment with, with little planning and training given.
- **Human knowledge:** It is usually long-serving employees who know how to coax a temperamental machines into working order and/can speak directly with other suppliers.

Driven by a fear of missing out, senior leaders are struggling to find usable information relevant to their domain and are in 'reaction mode'. There are a whole host of internal business reasons that mean new technologies are not being implemented effectively.

So how do we overcome that: The Funding & Support Gap
When asked about what government support for AI adoption might be available (specifically in the UK) I heard three typical answers:

- *"I have no idea."* and *'I am not sure where to look.'*
- *"There are funds around, but not for upgrading our machinery or systems."*
- *"The application process (eg.Innovate UK) is overly complicated, it's not worth my time for the investment."*

Made Smarter Programme: www.madesmarter.uk/

There was one relevant funding avenue that stood out: The Made Smarter programme which offers grants of up to £20,000 for leadership training and specialist technology guidance. As one funding adviser commented: *"We still see businesses with no WIFI on the shop floor. And beyond the programme, there's no onward support to maintain the new system."*

For some businesses, it is the ongoing support after the project has ended that helps to ensure that the technology is fully adopted. From experience a £20,000 grant will also not go far enough given the cost of subscription-based programmes and machinery alone.

UK schemes (Innovation Smart Grants, regional growth funds etc), are often hard to find, difficult to access and are at the mercy of changing Governments. Ultimately this means finance and expert knowledge is not reaching where it is needed most.

Germany Industry 4.0: Article

Germany’s power house and Vietnam's Frontier Economy

Germanys ‘Mittelstand’ (SMEs) play a defining role in the country’s economy producing highly specialised products. They are at the forefront of innovation and technology. Across the country there are 25 ‘centres of excellence’ as part of the Mittelstand 4.0, a network of centres directly set up to support SMEs with expert advice, training, ‘learning factories and networking’.

It is to be noted how competitive German companies have been in the wider global economy (up until recently) and what sustained Government support can do for SMEs (Mittelstand 4.0 was set up in 2016).

Tax Incentives for Foreign Enterprises in Vietnam: Article

Vietnam offers a favourable environment to overseas investors. In particular SMEs can apply for up to two years for a Corporate Income Tax (CIT) exemption, with a further reduction for the next four years. Additionally, they have access to favourable government loans, can receive import duty exemptions on fixed assets. Government offers include backed subsidies (covering as much as 50% of certain contract values) as well as access to heavily subsidised training for managers.

It is an optimistic country and often bends its foreign policy, known as ‘bamboo diplomacy’, to maintain its own interests. Its free trade agreements, low labour rates and geographical location are all reasons why it has experienced rapid growth, especially in its manufacturing sector. It is also due to its clear strategy to attract overseas investment. For example, Samsung accounts for 13% of the country’s GDP alone.

It is clear that unless policies translate into affordable tools, infrastructure, and SME-tailored support that meets very practical real requirements of businesses, the UK risks a widening gap between ambition and reality.

Learning's for the UK

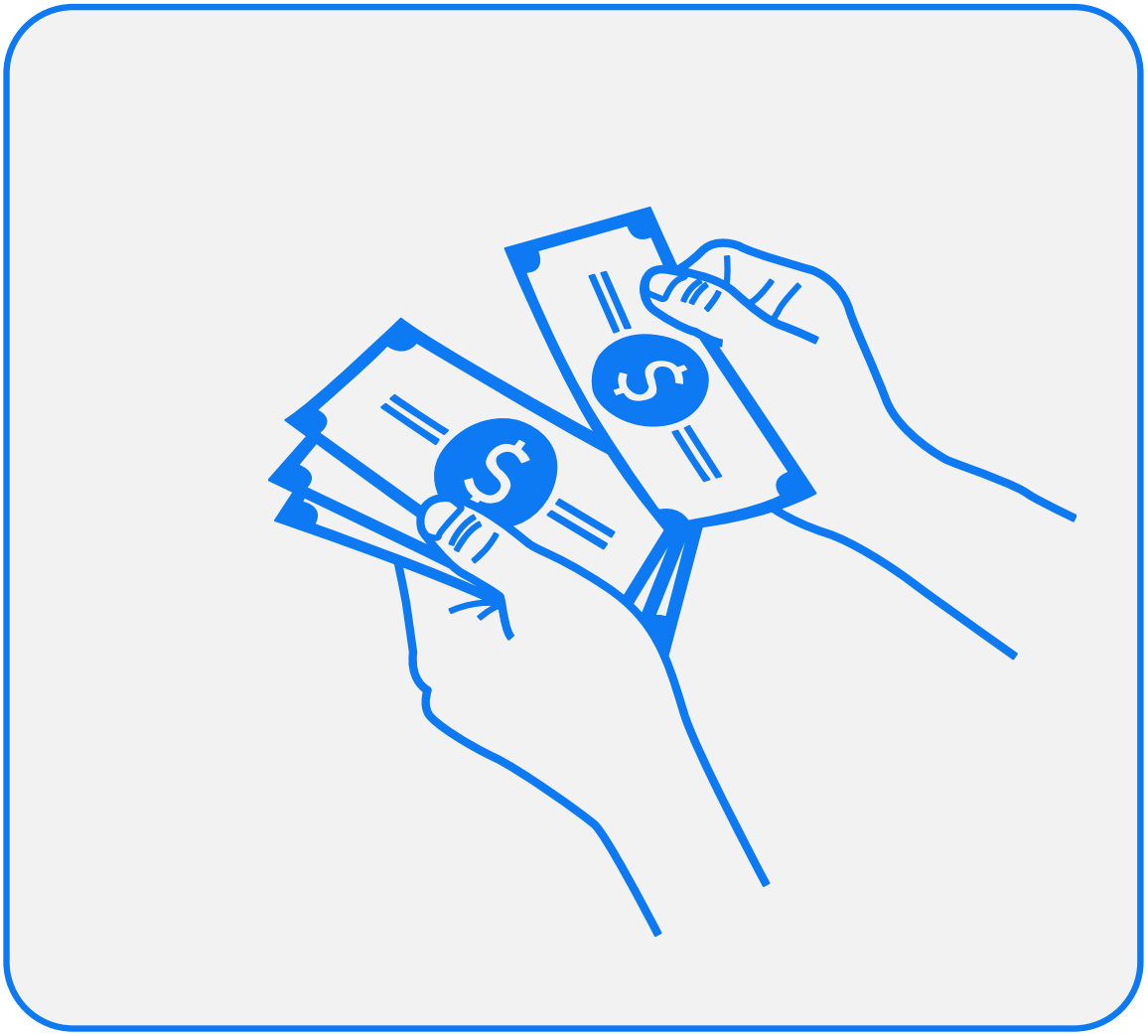
- **Funding viability:** UK policy could offer tax breaks or matched funding for upgrades to reach where it is most needed. For example, replace outdated legacy systems, provide funding to update machinery and tools. Key to this is making it visible and accessible.
- **Data Quality:** Businesses need help with what data they have, where it lives, and how clean and useful it is. An online tool similar to the self-assessment tool, AI Management Essentials (AIME), could work well as a baseline to help organisations prepare.

AI Management Essentials (AIME) tool: Gov.UK

- **Shared ‘Technology’ Hubs:** Regional facilities giving SMEs access to high-performance technology and industry expertise, training, and integration without financial outlay.
- **Domain-Specific AI:** Create manufacturing-focused AI tools, like MaVila by California State University Northridge, USA. Trained on relevant data (rather than generic data) it designed for specific industry needs, requiring less input and is more accessible for SMEs.

MaVila, USA: Article

- **Long term policy stability:** This all needs to be underpinned by long term government policy and support. The (current) Industrial Strategy looks out 10 years. Is that far enough? Will it hold if a new political party comes in?



The Divide:

Between ‘Big’ and ‘Small’ Business

“The future is already here, it's just not evenly distributed.” William Gibson

Textile Industrial Park in District 2, Ho Chi Minh City, Vietnam.

Large companies have more than just deeper pockets, they have integrated systems, dedicated R&D budgets, and talent that allow them to scale AI strategically. Contrasting that, most SMEs lack the capital, in-house expertise, and data infrastructure to experiment at speed.

Office for National Statistics: Management Practices (2023)

While the UK is the third largest AI market globally and home to leaders like Google, DeepMind, and ARM, actual AI use in manufacturing remains low. In 2023, only 5% of manufacturing firms reported using AI, compared to 9% in the services sector.

Real Business Pressures:
Consider a typical UK SME: a plastics injection moulding company in the North West, specialising in toolmaking, manufacturing, assembly, and quality control. Founded over 60 years ago as a family business, it has grown into a 50-strong team supplying clients from luxury automotive brands to household consumer goods, medical products, and construction materials.

The business recognises the potential that AI tools can bring, but are held back by economic instability that effects day to day business operations:

- Rising energy costs make it expensive to simply keep machinery running and keep the lights on.
- Overseas competition undercutting on price means a shortened sales pipeline.
- A lack of affordable mixed-use work space to grow into.
- As a consequence, the company faces a hiring freeze, paused apprenticeship programmes, delays in purchasing new equipment and difficulty to invest in new revenue streams.

Phillips Design Studio & Signify, High Tech Campus, Eindhoven.

Philips as a Big-Business Example

Inside Philips' Design Studio based at the Tech Campus Eindhoven, Netherlands, a designer can generate a fully formed user persona in minutes, complete with backstory and pain points using the company's internal AI model. This, tied with historical company data about its many consumer products, allows the business to develop new ideas and new business opportunities.

Established in 1891, Philips' has had quite the journey from light-bulb maker to global health-tech leader. With over 68,000 employees and hundreds of designers across 12 studios (worldwide), the company has been exploring and integrating AI technologies into both its internal processes and products for some time:

- Purpose built, internal AI models: built for security and IP protection, with deep domain specificity.
- Component libraries, code-backed building blocks that increase agility and conformity, cutting time from concept to product-ready designs.
- Integration of design into strategy, design is an equal partner alongside engineering, business, and its clinical teams.
- Clear business values aligned to product vision that inform where AI could help.
- Ability to create a "startup farm" (where multiple ideas are tested) with structured funding, milestone checks, and decision-making processes that prevent resource drain.

Culture as a Competitive Advantage

Just as much as governmental policy can include a business, so too does culture. Dutch heritage shapes Phillips decision-making through *'poldering*', where a majority consensus-driven approach rooted in the country's history of water management fosters a culture of shared responsibility. Final decision requires extensive alignment before action, but once decisions are made, commitment is swift and united.

This collective alignment in the context of the company's products is helpful when embedding new ideas and technologies into a complex organisation and go a long way to describe its resilience.

Why can't SMEs just copy this?
For SMEs, agility is often their only advantage. Smaller teams can pivot quickly and target opportunities overlooked by big business, but for every big-business advantage, there's an SME constraint.

Big Business Capability	SME Reality
Owned and custom built AI models with tailored security	Reliance on generic, off-the-shelf AI tools
Large and multidisciplinary design teams	One or two designers working across roles
Structured funding for R&D projects	On-off projects with no budget for iteration
Deep integration of design and engineering	Functional silos with little time for collaboration
Governance that supports long-term AI adoption	Short-term survival pressures

It's big business's ability to take confident steps into new technologies that ensure that they remain competitive. In areas where they are yet to expand and want to fast track their advantage 'they will just go and buy start-ups.'

Learning for the UK
The government's Modern Industrial Strategy acknowledges the need to boost productivity, but SMEs require more than high-level ambition. Phillips appears to be treating AI as an organisational capability, not just a tool. Crucially, if real 'ground level' business pressures continue alongside a lack of meaningful infrastructure updates to ensure confident adoption, UK SMEs will be left watching from the sidelines.

What would make a difference for UK businesses:

- **Energy subsidies for manufacturers:** Levelling the playing field with other industries would enable competitive sales prices on goods.
- **Tax incentives for skills and upgrades:** Tax reliefs for training, apprenticeships, upskilling, and digital infrastructure upgrades.
- **AI access grants for SMEs:** Targeted funding to de-risk early experimentation.
- **Shared AI and technology hubs:** Regional centres offering computing power, secure data environments, and integration expertise.
- **Skills programmes for specific domains:** Blend AI literacy with design, engineering and material knowledge specifically for the design sector. Training should be specific and applicable, not generic.
- **'Buy-local' procurement incentives:** Encouraging businesses to source within the UK to strengthen domestic supply chains and support local industry.
- **Availability of affordable multi-use work-spaces:** Purpose built flexible facilities for SMEs and start-ups, at an affordable price.

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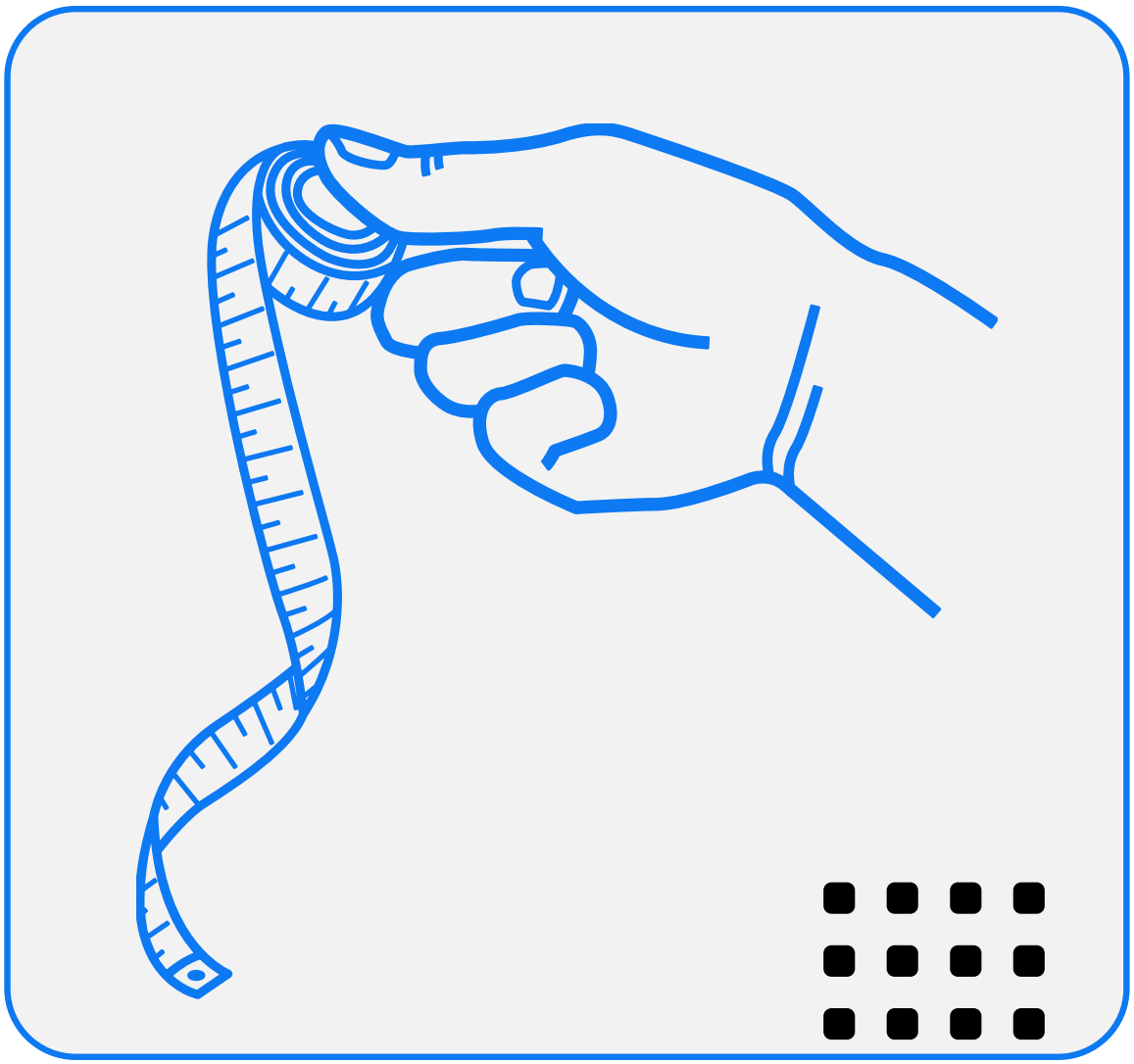
Designed in the EU.
Defined by regulation?



DAF Trucks, Eindhoven.

On Euronews in June (2025), Volvo's CEO Håkan Samuelsson was being interviewed about Europe's automotive industry. Headquartered in Gothenburg, Sweden, since 1927, the company is historically known for its safety, heritage and design, but it too has been facing difficulties in car manufacturing in recent years.

What particularly caught my interest from the interview was the statement: *'Volvo will develop different technologies for different markets, for example, China vs western customers as trade has become more fragmented.'*

'In our future we see that we will have to divide that, we will have certain software stacks for Europe and for the US, and other software stacks for China. I think we are going into a more regional world and there will be some restrictions on tech.'

Essentially the same product with the same brand name, would be engineered differently depending on where it was sold. For a large global company this is a complex challenge, but achievable. For a UK SME, the prospect of navigating different AI regulations, data sovereignty rules, and product compliance standards is a daunting task.

Why AI legislation, regional strategy and Governance matters for physical products

For businesses selling a physical product into the EU, a product must meet various safety and compliance standards such as CE Marking or ISO Certifications. These are used to demonstrate a robust quality process has been followed, which helps protect consumers, minimise environmental impact and protect IP.

Depending on which markets you want to sell into will define which regulations need to be applied. These certifications/regulations of course impact how a product is designed and developed.

Three ways in which AI ‘becomes’ part of physical products:

- **Design Tools:** AI-powered software that assists designers, engineers etc in analysing data, generating new concepts, and optimising product design.
- **Production Systems:** embedded sensors in manufacturing lines that monitor quality and enable predictive maintenance.
- **Final Products:** AI directly integrated into consumer goods providing personalised features whilst sending feedback to businesses.

The introduction of the EU AI Act is the most relevant legislation to look at in the context of this research, as most businesses are still trying to grapple with what it means for them. I found it most noticeable that it was those working IT Systems and Data Transformation roles, as well as those in large consultancies, had the most awareness of the EU AI Act.

However, it is the speed at which the technology, and its use, is evolving comparative to the speed of change in legislation. Additionally, countries and regions are moving at different speeds and with different priorities adding to instability in business road mapping.

Note of interest: Global AI Regulation Tracker

Though not a comprehensive table (mid-2025), it highlights the key agreements that were either in already in place or came into being during my research.

Country	Distinctive National Strategy / Plans	Notable Investments	Trade Agreements in Place
Germany	Strategie Künstliche Intelligenz (Artificial Intelligence Strategy, introduced 2018, revised 2023)	Has pledged about €5.5 billion to AI initiatives through 2025. Focus on: machine vision, automation, and manufacturing to leverage Germany's industrial strengths. Building 'AI Gigafactory' with NVIDIA in 2026. Aiming to develop research hubs, fund startups and SMEs and upskilling and public engagement.	Coalition agreement for 2025–2029 places priority on AI and digital economy integration with European frameworks, including support for the Eurostack initiative and aligning with EU-level digital sovereignty efforts.
Netherlands	Strategic Action Plan for Artificial Intelligence, 2019 & government-wide vision on Generative AI, 2024	Annual budget between €45-64 million for AI R&D, Triple helix’ model to foster partnerships between private sector, government and academia. Aims to be an EU leader in safe, responsible, human-centric generative AI, with strategies that prioritise public values, open access, and large-scale scientific infrastructure.	Closely aligned to the EU regulatory and trade initiatives. Established and leading semiconductor industry.
Sweden	AI Sweden Strategy (2024)	Cross-sector integration, focus on responsible adoption anchored in democratic values, active public sector piloting (AI pilot sandboxes), commitment to national data sovereignty. Funding proposals for investment currently being reviewed.	Sweden’s national policy is tightly coordinated with the EU’s AI Act, allowing Swedish businesses to benefit from unified European standards and regulatory clarity.
United Kingdom	National AI Strategy, 2021 & AI Opportunities Plan, 2025	Harness AI across sectors: healthcare, public services, infrastructure, business. Launch of AI Growth Zones (construction begins 2026), £2b to Expand AI Compute Capacity (rapid expansion of data centres).	Leads several multilateral forums (including the Bletchley Declaration) and works closely with the G7, US, EU. Digital Trade Agreement to emphasise open data flows. Various Trade Agreements including CPTPP.
Vietnam	National Strategy on the Research, Development, and Application of Artificial Intelligence until 2030 & Law on Digital Technology (2026)	Law on Digital Technology, offering tax, land, and investment incentives on long term foreign investment. Infrastructure investment: Nationwide 5G networks and green data centres. Offering regulatory sandbox approach for strict but 'friendly' regulations.	Leveraging ASEAN cross boarder collaboration to boost digital transformation. Major investments by NVIDIA and Google etc. Multiple trade agreements in place.
EU-wide	Legislation: EU AI Act (2024/1689)	Risk-based classification, high-risk conformity assessments; Feb 2024, mandatory provisions in place, Full enforcement from Aug 2026; Launch of InvestAI initiative (February 2025); Establishment of AI Factories (December 2024 & March 2025); Proposed Cloud and AI Development Act.	Extraterritorial application of EU AI Act impacts businesses outside the EU that offer or sell AI systems in the EU market.

Regulation is inevitable, but uneven

EU AI Act: Explorer

The EU AI Act came into effect on August 2024, and at the beginning of February 2025 the first provisions became mandatory for businesses. It is a risk-based classification system that applies to general purpose AI systems who's output affects people regardless of where the provider or deployer is located. The entire law will be in force by August 2026 (except for certain high-risk systems) and fines can be imposed up to 7% of a business's global turnover (up to €35 million).

It covers all EU members, but technically not the UK owing to it leaving the EU post-Brexit. If a business wants to sell into the EU, regardless of where they are based, it must comply with the legislation.

In addition, each country has adopted a national strategy targeting specific sectors and implementing different plans to both attract business opportunities and secure their domestic industry.

At the time of visiting Vietnam (December 2024), the country had no legislation in place, but did have a National Strategy since 2021. It is seeking to position itself as a leading AI innovation hub in Southeast Asia by 2030. It is focusing on developing talent, building a strong AI ecosystem (including startups and large tech companies) whilst it also builds innovation hubs and data centres.

In the absence of a robust governance framework, I had an interesting conversation with an Engineering Academic at RMIT MIT University (HCMC) who raised concerns about an absence of governance/legislation leading to catastrophic errors in safety-critical manufacturing: *"When things go wrong, how and why did they go wrong? Will we be able to find out why they went wrong in the first place? Whose responsibility is it?'*

DTI Law: Article

Since my visit, Vietnam has passed the Law on Digital Technology ('DTI Law') which will take effect on 1st January 2026. It has similarities to the EU AI Act in its risk-based approach, but is heavily weighted towards cultivating domestic technology growth, including additional tax incentives offered to SMEs. Vietnam is responsive and decisive in its 'bamboo policy' and it will place it as a strong leader going forward.

Alternatively, Sweden demonstrates how long-term, coordinated infrastructure and sustained governance decisions shape competitiveness decades later. Early broadband investments from 1998 onwards based on the IT Infrastructure Commission Report (including subsidised hardware in homes, building fibre optic infrastructure and cultivating competition between providers) has positioned it as Europe's most digitally advanced nation by 2005. Whilst also seeking to invest in strategic knowledge and talent, Sweden takes a more holistic approach: *'AI systems should be designed, operated, and governed in a manner that respects laws, human rights, values, and cultural diversity.'* (AI Sweden Strategy 2024).

British Consulate, Ho Chi Minh City, Vietnam

Another layer of complexity

Trade Agreements also have their role to play in technology adoption and business expansion. Whilst in Vietnam in December 2024, the UK joined The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), an agreement between 11 countries which reduces/eliminates tariffs on the majority of goods traded between countries. Whilst this agreement is primarily focused on the sale of goods across borders, it does also reference data flows and IP with regards to AI products and services.

These trade agreements add another layer of complexity to businesses buying and selling products overseas. The UK alone has 40 Trade Agreements in place with 74 countries in addition to the EU.

As a business it is difficult to understand what Legislation and certifications apply now, and in the future, especially when agreements have not been finalised. This makes planning out product lines years ahead a challenge. The product you launch in a years' time might suddenly not be eligible for sale in another country, or cost more to sell because of taxes.

It is no wonder that Volvo's decision to develop *'different technologies'* for different markets is underway and will probably be approached in the same way in the future by other businesses.

A market differentiator?
There is a general concern that strict legislation will stifle innovation, with only large companies being able to afford the time and resources for experimentation.
UK firms may find EU compliance costly but unavoidable, and whilst Trade Agreements like CPTPP open doors, product development is expensive no matter where it takes place. The challenge is ensuring SMEs (and start-ups) have access to technical and legal support to help level the playing field.

Providing ‘regulatory sandboxes’ (safe test environments for AI applications) to test new ideas would be beneficial, as would making training in standards like ISO/ICE 42001 (an international management standard for AI) more accessible.

There is huge value and importance with certifications, as they protect consumers, business IP and build brand loyalty (medical devices are a great example of this). AI certification could become shorthand for accountability and trust, becoming a market differentiator for businesses signalling quality, responsibility, and trust to consumers.

Learning's for the UK

Establish Regional AI Compliance Hubs:
- Provide SMEs with clear, sector-specific guidance on regulation, staffed by industry and legal experts who can demystify EU/UK/global standards.
- Encourage adoption of ISO/IEC 42001 to give SMEs a global framework for responsible AI use, provide training grants to assist in uptake.
- Offer ‘Regulatory’ Sandboxes, safe environments for SMEs to trial AI tools against evolving regulations and standards without heavy penalties.
- Fund cross-training so designers, engineers, and managers all understand compliance basics.

Modular design:
- Help businesses develop modular products where AI functions can be adapted, toggled on/off, or stripped back depending on regional standards.

Align Trade & Industrial Policy with AI Adoption:
- Embed AI compliance into trade agreements so AI-enabled UK-made goods gain easier international market access.
- Make it easier for businesses to access relevant information and team members at the UK Export Academy (Department of Business and Trade), and provide ongoing support to help businesses meet overseas suppliers/collaborators and sell their products.

Promote Certification as a Market Differentiator:
- Market certification as a trust signal (e.g. “Responsible by Design”) to open up markets and build brand value.

Incentivise Infrastructure & Compliance Investment:
- Mirror Sweden’s broadband subsidies to make compliance-enabling infrastructure affordable for SMEs. Tie AI adoption to favourable loans, tax breaks, and export incentives, committing to this investment for longer to provide stability.

Data as material:

Value, power and risk

Tagebau Hambach surface mine, Germany.

About 20 miles South-west of Dusseldorf in the Rhein region of Germany is the Tagebau Hambach open-pit mine. Mining of lignite (brown coal) began in 1978 and it is currently Europe's third largest surface mine. It is approximately 17 square miles wide, but has approval for expansion up to 33 sq. miles.

Owned by RWE Power AG, it extracts more than 40 million tonnes of lignite per year using some of the world's largest excavators. At 240 metres long these bucket excavators now sit where five villages used to be, including Lutzerath which was demolished in 2023. At peak times the mines output provided 5% of Germany's total electricity demand.

Data as a Material Resource
Like coal, data must also be mined. It must be captured, moved, stored, refined and distributed before being put into use. Each stage carrying costs, waste, and environmental impact.

With more and more 'AI enabled' products becoming common place in consumers lives, the need for and use of data has become increasingly more important.

But, where does the data come from?
Just as designers ask *'can we used recycled plastic for this enclosure?*' we should also be asking *'where does this data come from?'*

Through this research I began to understand just how complex global tech stacks are and how those involved in the design of physical products need to ask at all stages more about the source of their data.

Software Engineers I met said they source *'good'* data from wherever they can find it on behalf of their customers, though it *'primarily comes from the U.S'*. Conversely, product designers said they had no idea where the data comes to create imagery when using Mid-Journey or Vizcom.

Whilst OpenAI states that ChatGPT is trained on licensed data, publicly available sources (websites, books, articles, videos, etc.), and content created by users, it does not disclose the exact sources. This raises questions about copyrighted material, privacy and IP infringement.

"A sandwich has more regulation than AI."
Yoshua Bengio

The EuroStack Vision

Unlike coal, data grows in value as systems learn from it to generate better insights. Higher quality and more diverse data also leads to improved AI performance. Data itself, how it is used and by whom, has become very important.

Eurostack Report: Website

"Data Sovereignty", the desire for controlled national or regional data infrastructure, became a very hot topic of conversation right in the middle of this research. The EuroStack Report: A European Alternative for Digital Sovereignty, was released in February 2025, just days after The Artificial Intelligence Action Summit in Paris. It's a fascinating read, especially where networks, cloud servers and chip developers are located:

- 80% of Europe's digital infrastructure is imported.
- 70% of foundational AI models are US-built.
- Nearly 30% of Europe's "unicorns" relocated their headquarters abroad between 2008 and 2021, predominantly to the United States.

Currently there are approximately 477 data centres in the UK (third largest behind Germany and the U.S.), and another 100 are planned to be built in the next 5 years. Enormous sums of money are required and many of these are backed by big businesses such as Google and Microsoft. The risk here for SMEs is dependency on technology and software it doesn't own.

Again, there's an opportunity for government-backed "regional data hubs" that could reduce SME dependency, especially if they were domain-specific. AI models such as MaVila - the Manufacturing, Vision and Language Model developed by California State University Northridge, USA, which has been trained on relevant manufacturing data, can serve as an example.

MaVila, USA: Article

Environmental Impact

Further reading suggestion: Empire of AI, Karen Hao

Paper: Estimating the Carbon Footprint of BLOOM.

Yet this resource is not immaterial, it also depends on vast, hidden infrastructures with significant environmental costs to keep it running. Data centres are among the largest electricity and water consumers on Earth, and are causing severe strain to the local communities that are being built. The carbon footprint of training machine learning models is enormous and continues to grow.

Consider the life cycle of an “AI-enabled” smart fridge, which can be compared to the stages of traditional material production:

Physical Material Stage	**Data Equivalent**
Extraction: mining, harvesting	Capturing images from internal cameras, scanning barcodes, logging door openings
Transport & Storage: shipping, warehousing	Sending data to cloud servers for processing and storing history logs
Refinement: smelting, chemical treatment	Cleaning, structuring, and tagging image data so the AI can recognise food items
Fabrication: shaping into parts	Training recognition models; generating recipe suggestions; integrating with shopping APIs
Distribution: shipping to market	Delivering personalised shopping lists and recipes to user apps

Just as physical goods require raw materials, so too do the semiconductors themselves.

Further reading suggestion: Material World Ed Conway.

Semiconductors are built from a wide range of elements sourced globally. High-quality silicon is essential, as is aluminium, copper, gallium, germanium, palladium, and neodymium, among others. Once sourced, these materials need to be extracted, refined, and tested to ensure suitability, and performance.

From there they are shipped onward to Fabrication Facilities, most likely to TSMC in Taiwan. It is estimated that they manufacture 90% of the worlds most advanced chips, with production taking place over many months, including over 10,000 different steps. This all adds to the environmental footprint.

It is not only the processing of raw materials into semiconductors and the procurement of data that matters, the hidden weight of computation in a products use must also be considered alongside the visible costs of manufacturing. We must also recognise that when these semiconductors, and potentially data sets too, reach their End-of-Life, they will more than likely end up in landfill.

Circular design principles and stronger regulation offer a path forward. Just as metals and plastics can be recovered and reused, so too can datasets if they are carefully labelled, structured, and stored for future use.

Treating this data as if it is an infinite resource is risky. Just as manufacturers already inspect and certify their products or materials, businesses should apply an ethics frame work when using data in the process of designing products, and in their use too.

By treating data with the same seriousness as any other raw material, UK manufacturers can build products that are not just smart, but trustworthy, sustainable, and globally competitive. Without it, SMEs risk building on hazardous material, exposing themselves to recalls, penalties, and reputational damage.

Learnings for the UK

Regional Data Refineries

- Fund government-backed domain-specific hubs where SMEs can clean, standardise, and securely store product-use datasets.
- Provide SMEs with secure, controlled access to relevant data and AI models (e.g. manufacturing-focused models like MaVila in the U.S.).
- Reduce dependency on “big tech” data centres by giving SMEs access to trustworthy, affordable infrastructure with expert advice and guidance (Data Ethics Framework).

Circular Design Principles into Data Use

- Apply Life Cycle Assessment (LCA) to data, considering its sourcing, energy footprint, and “end of life.” Treat data like a raw material: label, catalogue, and store it for reuse and repurposing.
- Design products with modular AI functions that can be toggled/adapted for different regional compliance regimes.

Data Literacy Across the Workforce

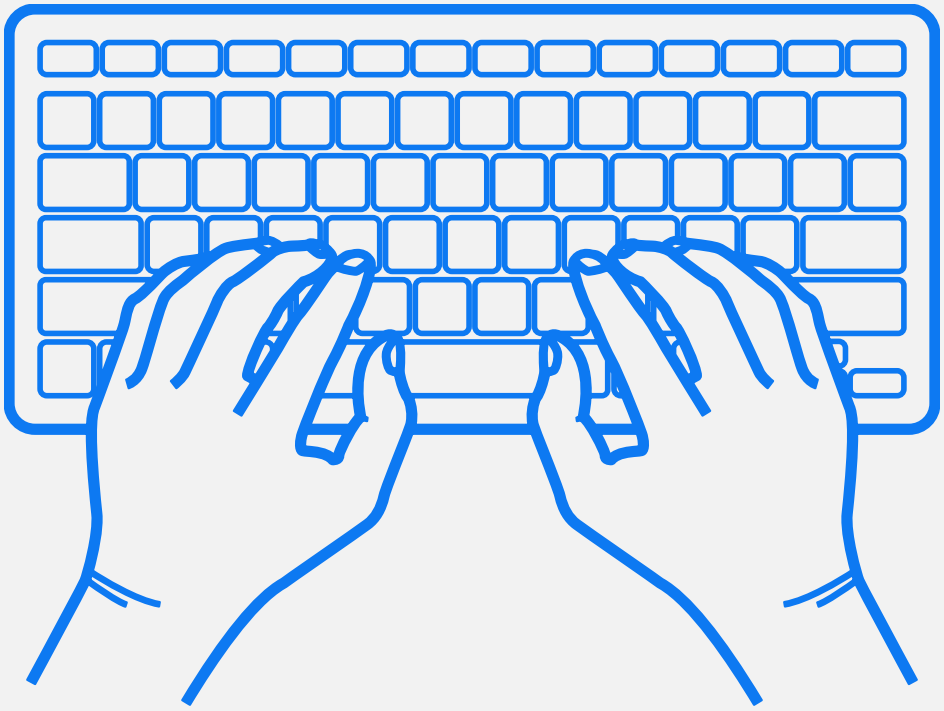
- Fund training in data retrieval, cleaning, and handling to ISO/IEC 42001 standards and upcoming EU/UK AI frameworks.
- Build organisational trust by making compliance and ethical data use a shared responsibility, not a siloed skill.

Ethical Data Certification as a Market Differentiator

- Encourage certification schemes for ethical data sourcing (similar to “Fairtrade cotton”) as a market differentiator, where trust and quality signal buy in from customers.
- Demand transparency from suppliers about data provenance, labelling conditions, and IP risks. Embed ethical assurances from providers to remove exploitative low-wage data labelling practices by third parties.

Made by Many, Designed by No One?

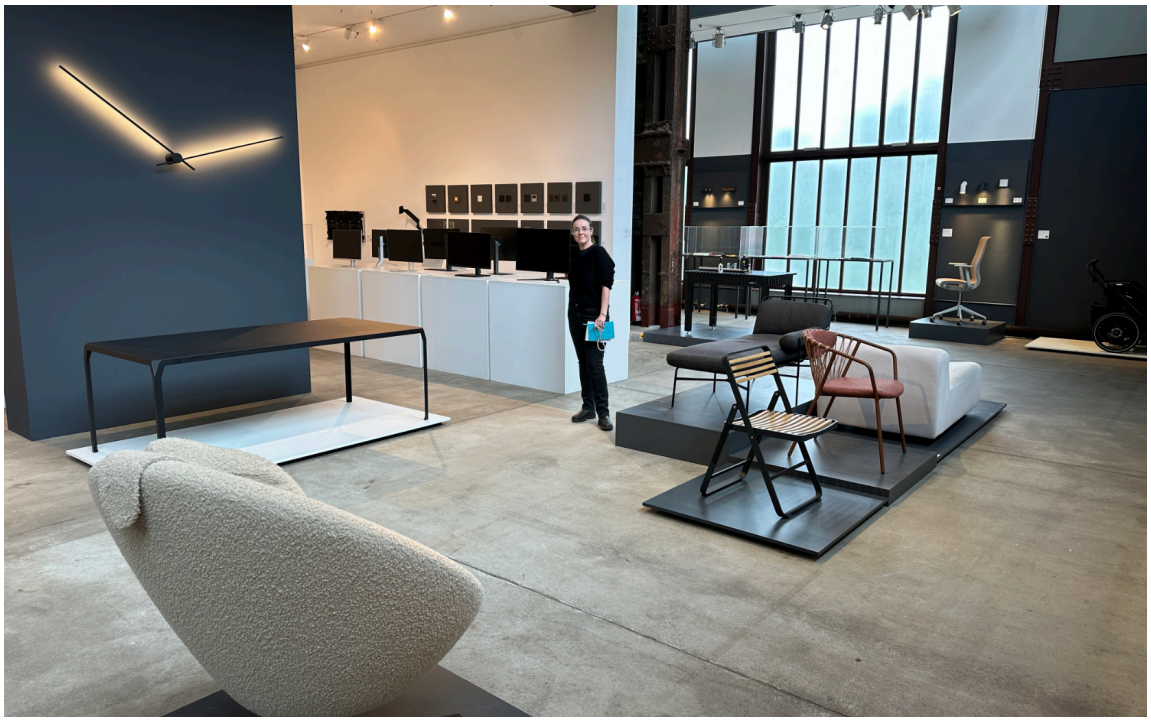
What happens to design (as a value, process and cultural force) when machines design the products we use and live with, not as individual tools, but in an integrated system?



The Chair with No Story
A package arrives at your home: a chair, perfectly contoured to your body shape, upholstered in a fabric that matches your living room exactly. It was conceived, prototyped, refined, and ordered without a single human designer touching a pencil, let alone a fabric sample.

An AI research agent analysed your online behaviour; a design agent generated hundreds of prototypes; an engineering agent ensured manufacturability; a supply-chain agent chose the cheapest certified factory with the lowest labour costs.

It fits you flawlessly. But when you're asked who designed it, you pause. There is no name. No design signature. No story.



Red Dot Design Museum, Essen, Germany. Displaying approx 1,500 products recognised for their innovation, functionality, and design excellence.

Why Design matters culturally
Design has always been more than function. Movements such as the Arts and Crafts or Art Nouveau were deliberate reactions against commercialism, asserting cultural values through objects. The rise of industrial design transformed design into a strategic force. The hiring of Louis Kalff by Phillips in 1925 proved pivotal in the business, as it modernised and unified product branding and communications.

This work relies on tacit knowledge, the accumulated experience of designers, engineers, suppliers, and craftspeople. This "human intelligence" bound together culture, commerce, and technology. Slow, inconsistent, and vulnerable though it was, it gave products meaning.

The AI Shift
Artificial intelligence now promises to replace much of this tacit process. Integrated into product development cycles, AI can move faster, cut costs, and seamlessly link research, design, engineering, and manufacturing. But it also risks making products, boring. Ones that have no cultural relevance, authenticity or value.

When the same generative model feeds design teams in London, Shenzhen, and São Paulo, the result is potentially an aesthetic convergence: safe, familiar and optimised.

Land Rover and Dr Martens products that became cultural markers, carrying place, craft, and identity in their design language, are now AI risks producing objects that are flawless and technically efficient but boring.

Authorship, Ownership, and Identity

When a product emerges from an algorithm trained on millions of precedents, what becomes of its authenticity, of its value? How do designers ensure values and vision survive? Will users still value the item itself?

- **Intellectual Property:** UK copyright and IP frameworks struggle to define ownership in hybrid AI - human workflows.
- **Innovation and Differentiation**: If Rolls-Royce and its competitors use the same generic models, how do they maintain innovation, IP and market share?
- **Consumer Value:** An Academic and Agency Owner in Eindhoven highlighted an interesting observation: *‘Today's students buy a new phone, and within a matter of years throw it away and buy a new one. There’s nothing wrong with it, and it gets regular software updates. But they don’t value the item itself, so they toss it.’*

New ways of making
AI does not only threaten, it also enables new models of making:

- **Hyper-Personalisation at Scale:** Localised, automated production that tailors’ products for individuals.
- **Living Products:** Products that evolve post-purchase through AI-driven updates.
- **Micro-Market Products:** Designs for niche communities, viable because AI reduces development costs.
- **Integrated AI Agents:** End-to-end ecosystems where market research, design, engineering, and manufacturing are automated, products conceived by AI before demand is consciously expressed.

But this raises a deeper identity crisis: are these products ours, or the machines? And what happens when products are optimised not just for humans but for non-human systems, robots, smart homes, automated logistics?

For UK SMEs, AI brings both opportunity and risk. Generative tools can compress research, prototyping, and engineering into the work of a small team, opening doors once reserved for multinationals.

Yet these same tools risk generalising output, stripping away the cultural differentiation that often defines SME competitiveness. Authenticity, once rooted in origin, craft, and human intention, will increasingly depend on how intentionally designers steer AI systems, ensuring the “human in the loop” remains more than a token gesture.

Learnings for the UK:

The UK faces a strategic choice. If design is undervalued as a cultural export and manufacturing as an economic resource, the UK's market share will slip to nations embedding design at the heart of industrial strategy.

Key priorities:

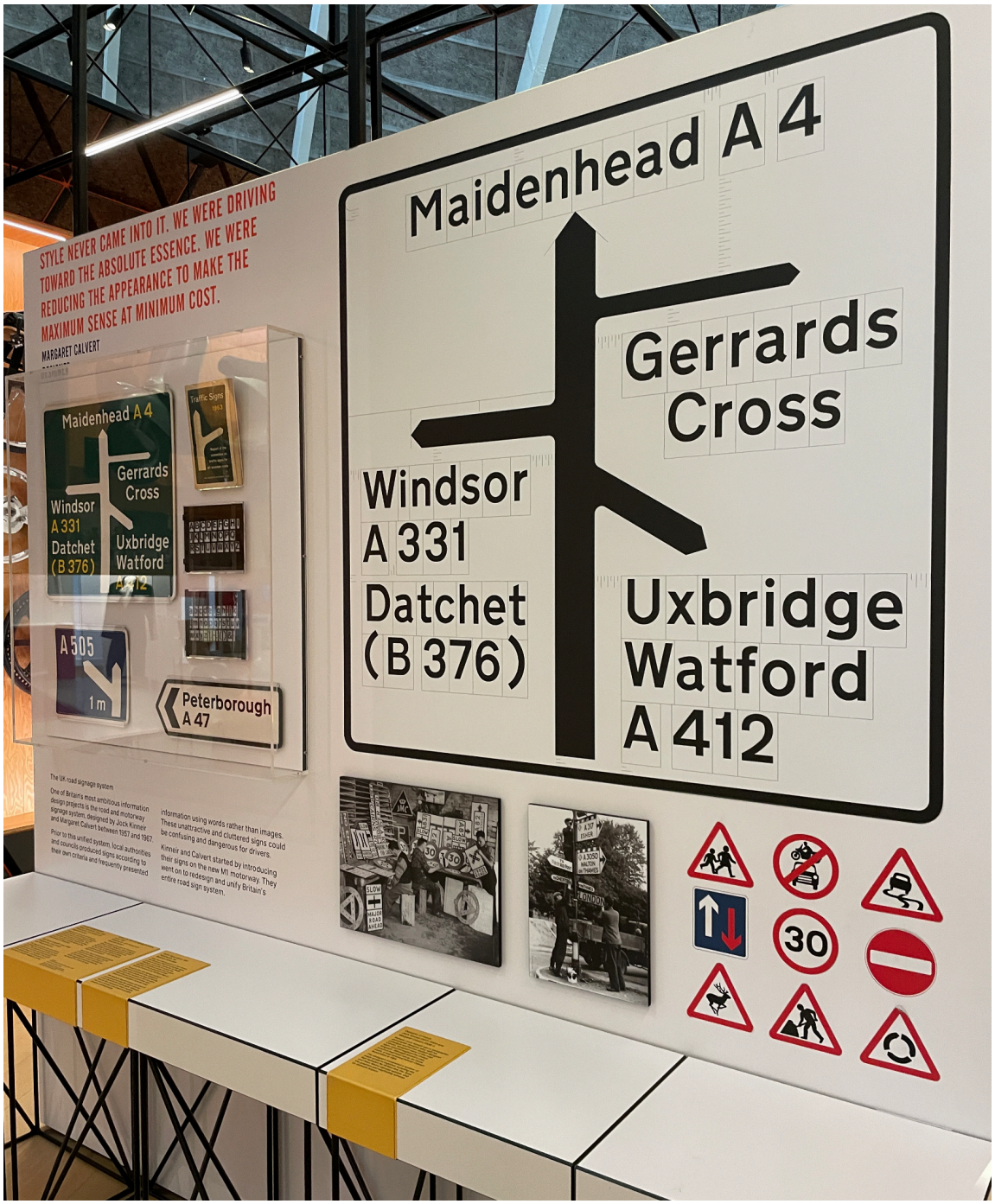
- **Creative industry competitiveness:** Recognise design as industrial strategy, not an afterthought (as highlighted in the Industrial Strategy Report 2025, which names creative industries as a high-growth sector).
- **IP Protection:** Clarify authorship and ownership in workflows to protect UK innovation and talent.
- **Heritage data-sets:** Curate culturally specific archives to train models that preserve identity, embedding regional heritage and craft.
- **Values-led collaborations:** Join AI agent networks but define cultural briefs that shape their outputs.

Ultimately, "Made in the UK" could mean two very different things:

- **Assembled here:** designed elsewhere by generic global AI models.
- **Created here:** products infused with British vision, values, and design DNA, even when realised with AI.

Which future emerges will depend on whether AI is treated as a cultural amplifier, or simply as a faster way to make more of the same.

Margret Culvert, Design Museum, London,



Conclusion:

Which direction?

Artificial Intelligence is no longer an emerging trend, but a disruptive force already reshaping how physical products are conceived, made, and traded. For UK SMEs, whose competitiveness depends on speed, flexibility, and distinctiveness, the stakes are especially high.

The UK's rich design heritage has produced some incredible products, world renowned brands, and employed millions of people. However, the continued erosion of this foundation will be accelerated with AI if it is not integrated with care and consideration.

This reports primary audience is for policymakers and government institutions, with SMEs as the secondary audience . Its aim is to inject "some reality to the current landscape", while offering practical guidance and advocating for meaningful, ground-level change.

Barriers: Foundation & Strategy

Practical AI adoption for UK SMEs is significantly hindered by a persistent lack of fundamental infrastructure, including inadequate connectivity, incompatible legacy systems, and limited access to clean, domain-specific data. Contrasted with the robust, sustained support seen in international examples like Germany's Mittelstand and Vietnam's incentivised growth, the UK is already behind.

The stark divide between the deep pockets and integrated systems of large businesses enables strategic scaling of new technologies and new products quickly. The intense, short-term survival pressures faced by SMEs limit their capacity for innovation and investment. Above and beyond the desire to use AI and all that it entails, if a business is struggling to pay its electricity bills and hire new staff, it doesn’t matter if AI existed in the first place.

Practical, Actionable, and Long-Term Recommendations

Rather than passive or reactive adoption, the focus should be on building resilient systems and capabilities.

Prioritise Foundational Investment
Implement long-term policy stability, provide targeted tax breaks and matched funding for infrastructure upgrades (connectivity, legacy systems, machinery), and support the creation of regional data refineries to ensure data quality and access for SMEs. Funding should be easy to find, accessible and not necessarily tied to academic research/ institutions.

Empower the Workforce and SMEs
Establish national upskilling schemes, modelled on Singapore's CCPs, to support mid-career workers as well as students and graduates. Training should be sector specific and applicable to individual business needs.

AI literacy and ethical leadership training for senior management should also be included to insure responsible adoption and minimise job displacement.

Streamline Regulation and Trade
Establish regional AI compliance hubs to offer clear, sector-specific guidance. Align trade policy with AI compliance requirements and make access to overseas knowledge networks, such as the British Embassy in HCMC, Vietnam, easier to find.

Explore modular data architectures to support compliance to meet different regional requirements alongside ethical AI certification as a market differentiator.

Complex Regulations
The impact of the EU AI Act and the fragmentation caused by diverse national strategies and trade agreements increases. This complicates product development and market access for UK businesses. The need for clear guidance and support for compliance is paramount to clear a long-term path way for strategic planning.

Precious Materials
Data, like steel or coal before it, must be treated as a critical raw material, with supply chains that are ethical, sustainable, and independent. Without regional data infrastructure, UK businesses risk over-reliance on big tech and generic global models. Investing in domain-specific datasets (e.g. MaVila,US) could help SMEs move forward with confidence.

IP and Authorship
Clarify IP ownership and authorship in AI workflows and curate heritage datasets to train culturally specific AI models. Value-led collaborations that guide AI agent networks in the future could be key to how these agents work and interact with overseas partners, bringing significant revenue to the UK.

The Essence of Human Design
The cultural value, authorship, and authenticity of design should not be undervalued. Creating technically flawless and profitable products is very appealing, but generic products that lack human intention and cultural relevance that define iconic creations (e.g. Land Rover, Rolls Royce engines) will be less likely.

Recognise design as a core component of industrial strategy. Provide sufficient funds into both primary and secondary education to cultivate design and critical thinking skills that will be needed in an AI future.

A Choice: "Made in the UK" or not at all

The choice is stark: will ‘Made in the UK’ mean products merely assembled here, simply derived from generic global AI models? Or will it mean products designed here, infused with human led values, vision, and cultural DNA, powerfully amplified by AI? The answer will determine whether AI becomes a cultural amplifier, or simply a faster way to produce the generic products at low cost.

The pace of development around AI remains both exhilarating and disorientating. When especially combined with global events, a dominance by ‘big tech’ and potential second wave of technology with Artificial General Intelligence and Agentic AI, clear human-led direction and investment are essential to ensure AI serves as a "cultural amplifier" rather than merely a faster way of producing the same generic outputs.

The future of UK design and manufacturing depends on embracing AI with intention, ethics, and a clear vision for human value.