DIGITLAB

CASE STUDY BROCHURE 2025

NHS JOBS: HOW SERVITISED PLATFORMS CAN MODERNISE OUR PUBLIC SERVICES

PROMOTING DIGITAL TRANSFORMATION ACROSS AGRICULTURE AND FOOD SYSTEMS

VERIS: TRANSFORMING AUTISM DIAGNOSTICS THROUGH DIGITAL BIOMARKERS

RESPONSIBLE DIGITAL TRANSFORMATION IN ANIMAL AGRICULTURE

DIGITAL TRANSFORMATION IN THE BUILT ENVIRONMENT

DATA-DRIVEN INNOVATION: INNOVATING PRODUCTS, SERVICES AND SYSTEMS WITH BIG DATA

AI AND DESIGN CREATIVITY

A FRAMEWORK FOR DATA MOBILIZATION FOR DIGITAL TRANSFORMATION

DIGIT LAB

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Launched in 2021, the DIGIT Lab is an Engineering and Physical Science Research Council (EPSRC) funded Next Stage Digital Economy Research Centre.

Digit Lab is led by the University of Exeter, in collaboration with the University of East Anglia, Oxford Brookes University, and Royal Holloway, along with more than 30 industry partners. We are backed by over £12M in funding, focusing on accelerating digital innovation and transformation in Large Established Organisations (LEOs).

The multidisciplinary team (design engineers, computer scientists, management scholars, behavioural and social scientists) works with a broad community of academics, practitioners, and policymakers across multiple domains, delivering new research insights into digital transformation.

DIRECTOR'S FOREWARD

Professor
Saeema Ahmed-Kristensen
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DIGIT Lab is a flagship UK centre, UKRI Next Stage Digital Economy Research centre focused on digital transformation for innovation, growth, impact and transformation for Large Established Organisations (LEOs). Understanding how Digital Technologies can be adopted, innovated for the next generation of products and services and their impact on the society is the key aim of DIGIT Lab. However, without a human-centred approach, Digital Transformation remains an incomplete field. DIGIT Lab brings together technology, organisations and people.

The challenges posed by an ever-changing, post-pandemic world, and the rapid developments in industry, resulted in a multidisciplinary approach and fantastic collaborations with 4 other academic partners and over 30 commercial partners.

The project works with a broad community of academics, industry practitioners, and policymakers across multiple domains, delivering new research insights into Digital Transformation.

DIGIT Lab's 5 research themes address Technology Adoption; Business Models; Organisational Structures; Working Environments and Digital Innovation, all focusing on Data and AI. Responsible Innovation is a cross-cutting theme across our research and engagement with stakeholders, shaping digitalisation with and for society. The Centre works across the sectors of manufacturing, Agri-Tech, public sector and professional services (insurance and finance). In our 'Lab to LEO' approach, we help organisations to re-imagine their business models, whilst applying the results of our academic research to real-life situations, people and companies.

By working with a wide range of researchers, we aim to understand how to innovate with digital technologies. Research areas include technology implementation and up-scaling, supply chains, connectivity, data access and use, innovating with data, job crafting, and responsible innovation.

> "DIGIT Lab has world-leading research that underpins the support large organisations need to adopt, innovate and understand the impact of digital technologies, particularly AI and Data"

Engineering and Physical Sciences Research Council

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IMPACT VISUAL AND TIMELINE

NHS Jobs: How servitised platforms can modernise our public services

Evidence shows that when the government fully subsidises these 'servitised platforms' by offering them to public service organisations at no cost, they will overcome their differences and adopt these services en masse. The resulting take-up will deliver many billions in savings every year, whilst simultaneously improving the services themselves.

Veris smartphone application

Thanks to DIGIT Lab, a scientist, clinician or designer can build and prototype an app to carry out user research by simply building a protocol file without any programming.

Sector briefings

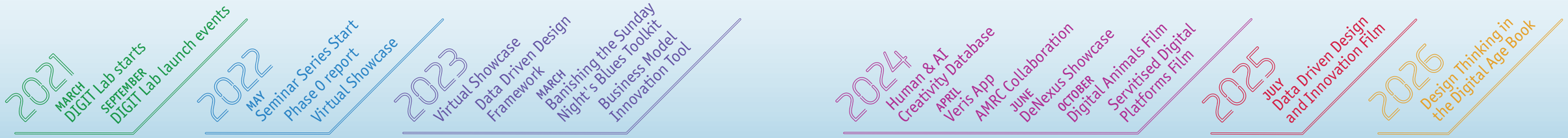
Sector briefings on digital technology, its adoption and impact. What are the opportunities and challenges in Manufacturing and Design, Agriculture and Insurance.

Digital Animals film

Our short documentary film 'Digital Animals' explores some of these issues in British agriculture. Our research examines how data and digital technology are transforming animal agriculture and what this means for both society and the livestock animals themselves. We aim to find new ways of co-producing data and digital technologies that are inclusive.

Data-Driven Design Framework

We have reviewed over 140 articles to identify how data and machine learning are used within the new product service development process. Through descriptive and thematic analysis, we have developed an evidence-based, data-driven design framework encompassing seven data-driven design activities – planning business strategies, understanding user needs, identifying product service requirements, generating concept ideas, customising products, maintaining systems, and supporting design decisions.



CHALLENGES OF ADOPTING DIGITAL TECHNOLOGIES IN THE MANUFACTURING SECTOR

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Background

The manufacturing industry plays a crucial role in driving UK economic growth, innovation and job creation. It is one of the biggest contributors to the country's economy, accounting for 8.6% of total UK economic output (gross value added) and 8.0% of employment in December 2024 (UK Parliament, 2025). The UK is the 12th largest manufacturing country in the world, and manufacturers are investing £38.8 billion into the UK economy every year (MAKE UK, 2024). It includes several sub-sectors, such as aerospace, automotive, chemical and pharmacy, and food and drinks. The manufacturers also act as a foundational layer in the supply chain for these sub-sectors, underpinning the end-product assembly and delivery.

To remain competitive in the global market, manufacturers continually seek new approaches and techniques to enhance efficiency, lower costs, and deliver high-quality products. The advancements in digital technologies, such as AI, Internet of Things (IoT), and big data, are transforming how these products are designed, produced, and maintained. However, it is challenging for the manufacturing sector to adopt these digital technologies due to barriers such as a lack of skilled workforce, high initial costs and trust and security concerns, as well as insufficient infrastructure (Made Smarter, 2017; Raj et al., 2020; Han et al., 2025; Yilmaz et al., 2023; Schönfuß et al., 2021). By overcoming these barriers to adoption, the UK could move towards highly automated and intelligent manufacturing, eventually becoming a global pioneer in high-value manufacturing. Quantum computing, for example, could accelerate drug discovery for pharmaceutical manufacturing, or enable ultra-secure communication networks for IoT devices. Resolving computational and infrastructural barriers would also unlock smart factories, circular economies, and mass customisation of products (e.g. 3D-printed medical implants) using real-time consumer data.

Current Issues in Adopting Digital Technologies

The main issues regarding the adoption of digital technologies in the manufacturing sector are summarised below:

Lack of skilled workforce:
Designers and engineers are lacking understanding and skills of emerging digital technologies, such as AI. As complexities of products in manufacturing may require different types of digital solutions. Although computerising of manufacturing has been advancing for decades, AI in its current form (LLMs in particular) has only been readily applicable for 2 years at most.

High initial costs:
Lack of a high amount of capital investment in adopting new digital technologies, and lack of awareness of available support and funding access.

Resistance to change:
Manufacturers have performed operations and manufacturing in conventional ways for years, and thereby naturally tend to resist changes.

Unclear return on investment:
It is unclear what the productivity gains and economic benefits are of adopting such digital technologies due to fragmented implementation across the value chain.

Integration challenges:
The current systems may not be compatible with emerging digital technologies, and thereby integrating new technologies with legacy systems can be challenging and costly.

Trust and security:
Trust issues in AI, and other digital technologies such as cloud services, with data privacy and security concerns, which hold manufacturers back from digital transformation.

Limited awareness and knowledge:
Although manufacturers recognise the need to improve productivity and efficiency, they have limited awareness and knowledge of adopting digital technologies.

Lack of infrastructure:
Manufacturers may not have the technological infrastructure needed, such as computing power, to implement new digital technologies

Generic solution unsuitable:
It is challenging to employ off-the-shelf technologies or digital solutions to address a specific problem in manufacturing. There are two reasons for this 1) privacy and 2) relevance to domain knowledge. Training on specific data or fine-tuning is needed when adopting AI technologies and applying them to new problems.

Data imbalance:
Data that is available to manufacturers, may be imbalanced, particularly when capturing data through sensors, which affects training models for deploying industrial IoT systems. Data is the foundation of all AI applications, and poor data makes for poor models.

Opportunities for Digital Transformation

Several opportunities are identified for better supporting the digital transformation in the manufacturing sector:

Transfer learning:
Using knowledge from one model to inform another model, supports the tailoring of solutions to new contexts. A large part of the pre-training process, the creation of "foundation models", is application agnostic. These models can then be further trained for specific problem areas.

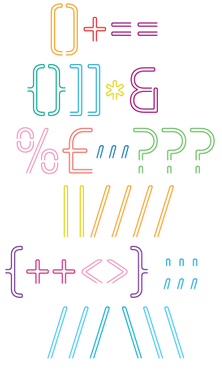
Federated learning:
Sharing model parameters instead of sensitive data to address privacy concerns. Digital transformation introduces multifaceted challenges, including data governance, retention complexities, and privacy risks, which often hinder the success of the transformation (Yilmaz et al., 2023; Schönfuß et al., 2021). These barriers, however, can be mitigated through privacy-preserving machine learning approaches such as federated learning, where model parameters (e.g., neural network weights are shared instead of raw data or entire models. By decentralising training and retaining sensitive data locally, federated learning enables collective model improvement without compromising confidentiality.

Tailored solutions:
Customising readily available AI and digital technologies for solving specific manufacturing needs, for example, using RAG models with domain-specific data.

Data-driven design:
Using data to support innovation of new products, components and systems (Lee & Ahmed-Kristensen, 2025). Decisions at all stages of a product's life-cycle can be informed by data insights analysis, which can then be fed back and used for predictive maintenance or design optimisation.

AI in design:
Applying AI in design and manufacturing to aid decision making, discover new insights and generate ideas (Han et al., 2025). Linked strongly with data-driven design, life-cycle data can be used in conjunction with AI models. Generative models can be used for a variety of activities, including design ideation and product optimisation, or personalisation at scale (Lee & Ahmed-Kristensen, 2025).

Process mining:
Is a critical tool for optimising work-flows by aligning digital transformation with lean principles and sustainability goals. It analyses logs and work-flow data to identify inefficiencies, bottlenecks, and deviations in processes, enabling organisations to streamline operations and establish a leaner foundation for digital transformation (Van der Aalst, 2016). By improving transparency and resource allocation, process mining supports sustainable practices and ensures that digital tools are deployed only where they provide measurable value, avoiding unnecessary technological complexity (Dumas et al., 2018; Lopes de Sousa Jabbour et al., 2020).



Future Developments

Future developments are explored, showing how emerging trends in digital technologies could shape the manufacturing sector's future. These future developments will help the manufacturing sector to benefit from increased productivity and competitive advantage.

Local large language Models (LLMs):
Deploying LLMs locally and integrating with internal databases, through Retrieve Augmented Generation (RAG), enables manufacturers to build secure and customised AI solutions. Such models operate within a company's local environment and thereby maintain data privacy suitable for data-sensitive contexts. Using local data for added domain knowledge can enhance model performance without the need for expensive model (re)training.

Localised cloud storage:
Hosting data via localised cloud services with data governance. Cloud provider like AWS provides such B2B services, enabling local data governance, which may support manufacturers with distributed operations.

Federated learning of distributed manufacturing:
Using LLMs as agents to enable collaborative intelligence, allowing federated learning from local data and exchanging the learning without transferring sensitive data. It can safeguard data privacy for distributed manufacturing operations.

Quantum computing for optimisation:
Quantum computing is emerging as a ground-breaking technology to solve infrastructure and computation challenges at scale. Quantum algorithms can evaluate solutions exponentially faster than classical systems. There are diverse applications and use cases of quantum computing, such as advanced simulations and supply chain optimisations. For example, building companies' data centres to leverage quantum algorithms can help manufacturers advance simulations, optimise supply chains, and accelerate material science.

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DIGITAL TRANSFORMATION IN AGRICULTURE

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Background

The U.K.'s agriculture sector plays a vital role in the UK food supply chain, producing around 60% of domestic food consumption, contributing £14[1] billion (0.6%) to UK GDP and £25 billion to food exports. It also provides significant rural employment, employing close to half a million people and supporting the continuation of rural communities, which are often some of the most socially deprived areas of the UK.

As a context for Digital Transformation it is important to recognise that the sector is heavily regulated, often driven by government policies and incentives, for example, via Environmental Land Management Schemes (ELMS) where farmers are paid to deliver environmental benefits. It is also highly regulated with animal welfare laws setting standards for animal husbandry, the control of pesticides, soil and nutrient management; by for instance, limiting fertiliser use near watercourses and preventing soil erosion as well as regulating food safety and hygiene, food assurance schemes (like red tractor) and more recently, ensuring net zero commitments are driving government and funding agencies to pursue carbon friendly farming.

The sector is also unusual in being dominated by just nine supermarkets that control over 90%[2] of the food retail market matched to a very large supply base of over 200k farms. No one doubts that the power in the supply chain resides with the supermarkets who dictate the terms of supply so that *farmers often receive less than 1% of the profit made in the supermarket[3]* reducing farmers to 'price takers'. This has led to cheap food in the UK but has also driven down returns to farmers to a point where investment decisions often become impossible without much longer-term contractual arrangements.

Our recent report examines some of the opportunities and challenges associated with the adoption of digital technology in Agriculture. These were considered at a joint DIGIT Lab and Agri-TechE held in Norwich in December 2024, organised by Professor Gerard Parr (Co-investigator) in DIGIT Lab. The following sections include findings from the workshop alongside dedicated research from the DIGIT Lab team.

Technology Adoption Opportunities

In 2013 the *UK Strategy for Agriculture Technologies* (UK SAT) set out an ambitious goal of making the UK a world leader in agricultural technology, innovation, and sustainability. In the years since that strategy was produced, the sector has attracted significant government investments, such as the Strategy for Agricultural Technologies (£160m over five years), the Agri-Tech Catalyst (£15m), four new Agri-Tech centres, and the Transforming Food Production programme. The potential for international trade is enormous, with major reports estimating the current market size for Agri-Tech products and supporting services at around $20 billion in 2021, with a projection to reach $46 billion by 2030 at a CAGR of 17.3%.

Following on from these initiatives and post Brexit, the Secretary of State for Agriculture commissioned a review of automation in horticulture led by Professor Simon Pearson (2022)[4]. The review identified six key clusters of technologies that could help accelerate the adoption of automation in horticulture, with three of these identified as first-wave technologies, including optimised production systems (such as improvements to infrastructure, canopy architectures, and ergonomics), pack house automation, and field rigs and mechanical systems. These technologies are immediately and widely available for mass adoption.

A further three technologies, that is to say, autonomous selective harvesting brackets (e.g. mobile robotic systems), augmented work (including Artificial Intelligence and collaborative robots), and autonomous crop protection, monitoring, and forecasting (such as robotics sprayers and free counting) are in later stages of development and remain unavailable at scale.

The report concludes with three themes for the way forward: securing a source of labour before the mass adoption of technology becomes feasible, engaging government, industry, and academia to increase and accelerate the mass adoption of technology, while also providing the necessary infrastructure, funding, and support for sectoral revolution.

Building on the review of horticulture, our Norwich workshop identified a number of specific technologies that are likely to be adopted including:

- Precision agriculture such as drones, providing opportunities to optimise input use, increase yield and therefore increase productivity; reducing waste and environmental impact.
- Farm management software, enabling farmers to track crop cycles/livestock and formalise data management.
- Automated machinery, for example, robotics including self-driving tractors, autonomous drones, which will help reduce labour costs (and shortages) and improve consistency in planting, weeding and harvesting.
- Climate and soil monitoring through weather stations and soil centres.
- AI analytics that will help with predicting crop disease yield forecasts and enable much higher personalisation of farming recommendations.

Technology Adoption Challenges

Skills:

A major challenge to the adoption of digital technology continues to be the lack of suitable skills. Areas of high agricultural employment in the UK, for example, Lincolnshire, East Anglia and Devon and Cornwall, tend to have low levels of educational attainment and occupational skill levels. For example, the UK's largest food-producing county, Lincolnshire, ranks in the bottom decile for those in professional and associate professional occupations, while is at the top for those in elementary occupations, such as basic manual labour. Hourly pay is just 85% of the national average (bottom decile) with female full-time workers receiving just 82% of the national average.

The impact of digital technologies will depend on the types of agricultural jobs being considered. Our workshop report highlighted the difference between 'cognitive' and 'dexterous' impacts. For example, a robot can replace relatively simple dexterous activities but not more complex tasks. Furthermore, many robots are designed for a single crop or task (for example, weeding), whereas other tasks, e.g. pruning, selective harvesting or disease detection, require a considerable amount of nuanced judgement. Cognitive tasks such as those involved in decision-making around the farm, for example, crop yields, pest control, irrigation, and planting schedules, are often based on uncertain information and seem suitable for the adoption of AI. A recent paper by Marinoudi et al (2024) considered agriculture's exposure to LLMs capabilities and concluded that around 45% of agricultural tasks have either high or partial exposure to LLMs.

Data and data sharing:

Our Norwich workshop highlighted a number of digital technologies which are working well and effectively including: GPS positioning; yield mapping: farm management software such as Yagro; robotic weeding and the precision application of technologies such as See and Spray from John Deere. However, the workshop attendees outlined a number of challenges, including the importance of 'correct data entry'. There was widespread acknowledgement that much data is still kept in handwritten form with a considerable historical backlog. Where data is transferred to a digital form this is often through such basic systems as Excel.

The major barrier to data sharing was one of trust amongst the various parties. Delegates acknowledge that investing in early-stage technology is always risky. For example, the lack of standards amongst technology providers acts as a significant lock-in and has, for example, led to some of the larger farming businesses building their own solutions. There is a significant portability challenge in extracting data from spreadsheets or proprietary cloud platforms and integrating that with the core dataset that underpins the business.

Delegates were also significantly concerned around who owns the data and the sharing of that data without their consent or receiving any financial return. Added to this, there is the cyber risk of any device which is connected to the Internet. This may not be restricted to relatively low-level 'hacking' but a concerted effort by a state actor could significantly impact UK food supplies.

Impact of climate change:

Climate change acts as both a driver of and a barrier to the adoption of digital technologies. For example, increased variability in weather patterns and attendant water shortages or floods lead directly to disruptions in planting and harvesting; longer growing seasons might allow for new crops or multiple harvests, but they may also bring heat stress and changing pest pressures. Extreme weather events can also lead to infrastructure damage in areas which already have challenges in digital communications.

An arresting example of the impact of UK farming practices in climate change is the use of soy as the primary method for livestock feed. Approximately 60% of these soy imports come from South America, where production is often linked to intensive pesticide use and environmental concerns. These include biodiversity loss, deforestation, and freshwater depletion, with an estimated 143 million metric tons of CO_2 equivalent (2006–2017) attributed to deforestation in the Amazon and Cerrado biomes in Brazil[5]. Substantial additional CO_2 emissions arise from transportation and processing, both in South America and/or in the UK (Gil, 2020). Using digital technologies to support the development of alternative protein production (e.g. pulses) can help to mitigate this challenge.

Technology solutions exist at farm level to help reduce the impact of climate change, but the most impactful behaviour through which digital solutions can mitigate the impact is likely to be increasing productivity and therefore reducing land use and harmful practices.

Digital solutions around precision agriculture, better long-term weather forecasting, crop modelling, and environmental prediction to manage livestock will help farmers respond better to the challenges of climate change. These innovations around data collection, management and interrogation provide the option to do "more with less" and for the industry to have a lighter environmental footprint.

Business models:

One of the often-overlooked barriers to the adoption of technology is that, with over 200,000 farms, there is considerable variation in business models across farm types, sizes, and locations. This provides agricultural technology suppliers with a challenge in scaling their product development and also in customising their products for each type of farm.

Clearly, some technologies have the potential to bring about radical shifts in productivity e.g. automated weeders for vegetable growers, others are likely to be more marginal gains. Large farms are of course, likely to be early adopters, with smaller farms struggling to find the necessary capital. Many small farms remain financially precarious with rising input costs (i.e. labour, fuel, pesticides) making the situation even more challenging.

Future Developments

Agriculture is clearly an area ripe for the adoption of new and emerging digital technologies and this is recognised in the Industrial Strategy[6]. As highlighted throughout the industrial strategy, the problem appears to be not in the development of the technology but rather in the adoption. Agriculture has some very specific challenges that are outlined here, including adapting to climate change, skills shortages and frequent changes to government policy. In addition, the harsh physical and complex regulatory environment alongside a heavily fragmented industry with limited financial room for manoeuvre, making for a highly complex digital transformation challenge.

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DIGITAL TRANSFORMATION IN THE UK INSURANCE INDUSTRY

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Background

The insurance sector in the UK and worldwide is being disrupted at great speed by the application of General-Purpose Technologies (GPTs) – driven by machine learning and Artificial Intelligence (AI) – to core areas of the business that have not changed for hundreds of years. In particular, digital technologies and AI are fundamentally transforming long-standing actuarial practices, including how we understand and underwrite risk; bringing rapid improvements that will make new data insights available to insurers, whilst also helping them to improve interoperability, resolve information asymmetries, and engage in business model innovation, such as the automation of claims procedures that may be more efficiently handled by AI Agents. As significantly, the insurance industry is being revolutionised by Open Finance (OF) and smart data initiatives that are likely to prove fundamental in the future and which are, for this reason, the main focal point for our research contribution to DIGIT Lab (Work Package 2).

Opportunities for Digital Transformation via Data Liquidity

The insurance industry is foundational to the UK economy acting as a key enabler of socio-economic resilience, while also providing long-term financial sustainability for the economy, underpinning personal security, business continuity, and public infrastructure by absorbing and distributing risk. Much of the work of the insurance industry relies on 'data liquidity' – or the ability to convert data generated from insurance transactions into opportunities for value creation. However, in the insurance industry, data sources are frequently locked away in silos or stored in outdated legacy systems, limiting their full potential. In addition to being siloed, the sector continues to rely heavily on document-based processes across various operations, from customer on-boarding and underwriting (evaluating risk profiles) to claims management and client engagement.

The growing accessibility of key GPTs means that value can be unlocked from these data points. A new generation of 'no-code platforms' and machine learning technologies is converting unstructured data into usable formats, paving the way for increased 'data liquidity '– the ability of digital information to be shared and traded efficiently between parties. This development is especially advantageous for tech companies that can acquire, integrate, transform, and capitalise on data assets.

Research Focus

While data access has traditionally flowed in a single direction, from incumbents to new players, our research for Digit Lab has included observing instances where start-ups introduced external data sources to benefit incumbents. In some cases, ventures re-purposed information held in legacy formats by established insurers, converting it into structured data to enable new services or streamlined processes. Others, particularly those with experience in similar industries (like banking) or access to novel data sources (e.g., satellite or weather data), offer insurers improved underwriting capabilities by combining these datasets with sophisticated algorithms.

Across all scenarios of data types and flow directions, the value of data is evident to all parties involved. At a micro level, it fosters the creation of innovative business models, reduces operational costs, and enhances service delivery for both data providers and consumers. More importantly, it delivers broader social value by promoting transparency, accountability, and informed decision-making, while also democratising access by aligning with users' needs. On a macro scale, increased data liquidity transforms data into a dynamic asset that fuels digital transformation and drives economic growth, not just within insurance but across the broader financial ecosystem, laying the groundwork for a more connected and inclusive Open Finance landscape.

Open Finance (OF)

Open Finance (OF) builds upon the foundation of Open Banking (OB), extending its reach across the broader financial ecosystem. For the insurance industry, it opens up new possibilities by facilitating access to a wider array of financial data sources and enabling more seamless collaboration across the financial sector. It aims to create a more transparent, interoperable, and consumer-centric financial framework. In this framework, it is predicted that the insurance data holders or Third-Party Providers (TPPs) will no longer be a standalone entity but part of a broader financial service architecture. This means that different entities in the insurance ecosystem could expand their business offerings, as well as be required to adapt to changing data control with their current and future clients.

The advantages of OF for the insurance industry are expanding the scope of data sharing in two key ways: first, by integrating data from diverse financial services, i.e., including underwriting, claims, and risk assessment data, and second, by empowering consumers with greater control over their data. As highlighted by Xu and Dukes (2022), this increased transparency and control can help alleviate consumer concerns, encourage engagement, and enable more personalised, data-driven insurance products and services. With richer datasets and improved customer insights, insurers can offer tailored coverage, dynamic pricing, and better decision-support tools.

By harnessing advanced data-sharing technologies, OF paves the way for innovation across the financial industry, supporting not only enhanced operational efficiency but also broader goals such as financial inclusion and risk transparency. At the same time, regulators are still working to establish robust frameworks to safeguard data privacy and consumer rights in this new, more connected landscape (Arnal and Andersson, 2024).

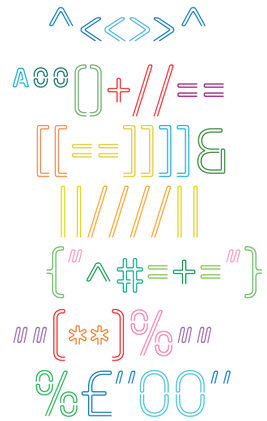
It is also important to note that broader data regulatory evolution is currently undergoing in the UK and EU, where "smart data" — or digital data generated through engagement with digital platforms and systems - is in the process of being formally regulated. The UK's Digital Information and Smart Data Bill (Duncan, 2024) will govern Open Finance initiatives, including those in the insurance sector, under broader smart data regulations (UKRI, 2024). While the bill applies across multiple domains, Open Banking remains the only live and mature smart data scheme to date. As such, the expansion of OB into OF, especially within insurance, represents both a critical innovation frontier and a practical test-bed for smart data regulation. The regulatory approaches established for OF in insurance are therefore poised to shape the future of data-driven innovation across other industries as well.

Future Developments

The future of insurance in the UK is being reshaped by digital transformation, data liquidity, and regulatory technological changes. While the sector has traditionally relied on legacy systems and document-based work-flows, emerging technologies like AI, GenAI, and no-code platforms, including AI Agents, are enabling greater system interoperability and smarter risk assessment, creating better information systems that can benefit consumers with more customised premiums. These changes are unlocking new asset classes and business models, particularly within the industry, as well as cross-industry collaboration.

In the coming years, Open Finance will catalyse this industry by allowing insurers to integrate claims, underwriting, and even external data from sources such as weather forecasting or the client-specific personal data insurers hold, enhancing customisation, transparency, and customer control. As smart data regulations evolve under the UK's Digital Information and Smart Data Bill, insurers will be required to adopt more open, interoperable data practices.

However, challenges remain. Many firms in this complicated ecosystem still operate in a fragmented way, for example, when on-premises or operating in circumstances where firms struggle to connect to cloud computing platforms, with still unclear guidelines on risk-controlled development (or adoption) of AI systems. More so, innovation is often siloed, and long-term strategies for systemic risks, such as quantum threats are underdeveloped. Nonetheless, the convergence of technologies, growing data availability, better granularity, evolving policy, and cross-sector collaboration, should enable the UK insurance industry to transition from being a reactive innovator to a more proactive and flexible data-driven industry.



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NHS JOBS:
HOW SERVITISED PLATFORMS CAN MODERNISE OUR PUBLIC SERVICES

Overview

Professor Thompson's work for DIGIT Lab (Work Package 5) explores new and emerging business models relating to the digital transformation of large-scale public service organisations.

Based on collaboration with senior health leaders, the NHS Jobs use case proposes a new operating model for public services that could transform vertically integrated information silos into common information systems via a platform architecture designed for agile deployment across the UK public sector.

Collaborators include a housing association's Chief Technical Officer (CTO), a freelance housing association's Chief Operating Officer (COO), a local authority's CTO, the COO of a local government technology firm, a data science entrepreneur, and several individuals connected to the development and delivery of NHS Jobs.

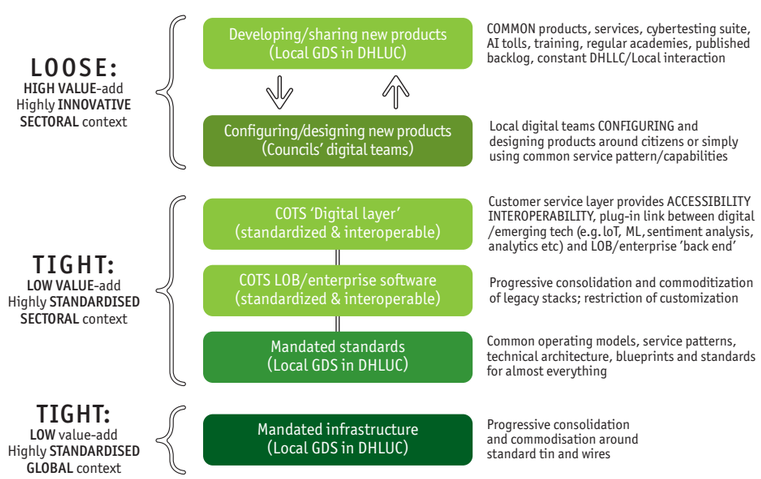
NHS Jobs presents a radical blueprint for real transformation as opposed to initiatives that merely improve the front end but leave underlying structures intact, generating significant opportunities for public sector reform.

Digital technologies play a significant part in the healthcare we receive at clinics, hospitals and increasingly within the home via telemedicine. The hospital 'back office' is not often thought of as a space for innovation and yet, digitalising healthcare administration is one of society's most pressing concerns, given the sheer scale, scope and complexity of the paperwork involved in delivering healthcare services. Part of the funding we have received for DIGIT (Work Package 5) has been used to explore an exciting and innovative approach to reducing the duplication of corporate activity between healthcare providers, while also helping to ensure that agencies work together for the betterment of stakeholders in the National Health Service (NHS).

Our work in this area (led by Professor Mark Thompson) focuses on minimising the repetition that often creeps into service delivery, where one or more agencies are involved. This duplication wastes billions of pounds each year, preventing services from working effectively. Several models have been tried for sharing common functions and services, including national technology projects, none of which have proved particularly successful in amending the siloed structure of public services. The case of NHS Jobs demonstrates that digital technologies can be used to promote collaboration across boundaries, which in this instance involved 700 separate organisations connected to the Department of Health via an external supplier-managed browser-based coordination function, achieving 100% adoption.

The 'servitised' model behind NHS Jobs offered an 'out-of-the-box', easily consumable alternative to installing and managing a bespoke IT recruitment system or application. This model is unique in public services and offers powerful inspiration, as well as a valuable blueprint, for modernising other public services along similar lines. Professor Thompson's contribution to Work Package 5 considers why NHS Jobs was so successful, identifying transferable lessons of benefit to other public service providers, for whom servitisation and common platform models might help save billions from public service budgets.

Tight - Loose collective operating model for local government



Further dissemination work

Public service providers are consistently challenged to deliver 'more with less'. This includes grants to local authorities, which were cut by 40% in real terms between 2009/10 and 2019/20. Current predictions suggest that half of councils could issue Section 114 notices in the next five years. While they enact responsibilities for education, transport and the environment, much of what our local councils do is health and well-being-driven, necessitating close cooperation between health and social care agencies and practitioners, particularly where the safeguarding of children and vulnerable adults is concerned. Reducing duplication across agency boundaries would help lift many of the time, cost and efficiency burdens associated with inter-agency working in the locality.

Concept origination

Taking inspiration from supermarkets, imagine if every store were to run its own corporate function, each with its supporting network of suppliers, drivers and so forth – busily commissioning their own bespoke functions and services, all with their own time-consuming office politics. Any supermarket operating on this principle of 'wheel reinvention' would quickly go to the wall. Happily, like all modern digitally enabled organisations, retailers recognise that local focus is best delivered via a common back-end office infrastructure.

An agile and responsive NHS

NHS Jobs is a test case for the adoption of this ethos within health delivery contexts. To our knowledge, it is the only example of 100% voluntary take-up of a common service platform achieved in UK public services: it is thus a pathfinder model for how the adoption of shared digital infrastructure can lead to local services that are more responsive, efficient, and aligned with users' needs – whilst increasing inclusion (any person or organisation with access to a browser can use it) – at a time when this is crucial for everyone.

Analysing success factors

Our detailed analysis of the adoption process explains how this unusually successful outcome was achieved, distilling the generic characteristics of the operating model while also providing an initial indication of how this thinking may transform other public services using local government and social housing as example sectors.

Awareness raising

DIGIT is supporting vital work in translating the servitised platform model from industry to public services, beginning with NHS Jobs. Accordingly, NHS Jobs may be viewed as a blueprint for tackling siloed duplication in public services more generally, with the goal of generating significant improvements in public services alongside reductions in cost.

Our report, therefore, constitutes a call to arms for policymakers across UK public services to consider where the servitised platform model exemplified by NHS Jobs can be replicated to achieve similar improvements in service quality and savings.

Impact and events

- The platform model we propose was discussed in two Cabinet-Office-run CDDO 'fireside chat' events (March and May 2024) with the Government CTO, Government CDO, and top technology officers across government.

Planned events include:

- A video explaining the concept.
- A 1-day workshop with senior executives and policymakers in local government (Institute for Government).

  Presentations to tech suppliers at TechUK & the Digital Leaders Forum.
- Further dissemination activities are likely to include targeting MPs, the Tony Blair Institute, LocalGovDigital, policymakers, and journalists interested in public services funding.

Publication outputs include:

"NHS Jobs: How servitised platforms can modernise our public services"

An article in Computer Weekly

Blogposts about common infrastructure in local government

A talk at the Times Higher Education Digital Universities UK 2024 and associated podcast.

Professor Mark Thompson
University of Exeter

> "Although just as essential to the delivery of the care we need, we are less likely to think of the hospital 'back office' as a space for innovation"

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PROMOTING DIGITAL TRANSFORMATION ACROSS AGRICULTURE AND FOOD SYSTEMS

Overview

Farmers and food producers are facing increasingly tough challenges linked to climate change and geopolitical upheavals, curtailing the flow of raw materials and finished products through the international supply chain.

World conflicts are taking a particular toll on the international availability of farming staples such as fertiliser. Resultant price volatility has had knock-on consequences for energy costs and the availability of labour, causing skills shortages. UK farmers have also borne the brunt of cost overheads resulting from Brexit and the drive to support the UK in achieving its Net Zero targets.

The continued digitalisation of farming and food production may help the sector to negotiate its way through these turbulent times more effectively, by for example, improving the accuracy of crop predictions or reducing waste.

As part of their contribution to DIGIT (Work Package 1), Professor Gerard Parr and his team at the University of East Anglia are developing next-level beta testing, allied to implementation frameworks that will deliver improvements in agricultural productivity that go beyond normal expectations for prediction and prevention.

Digital transformations

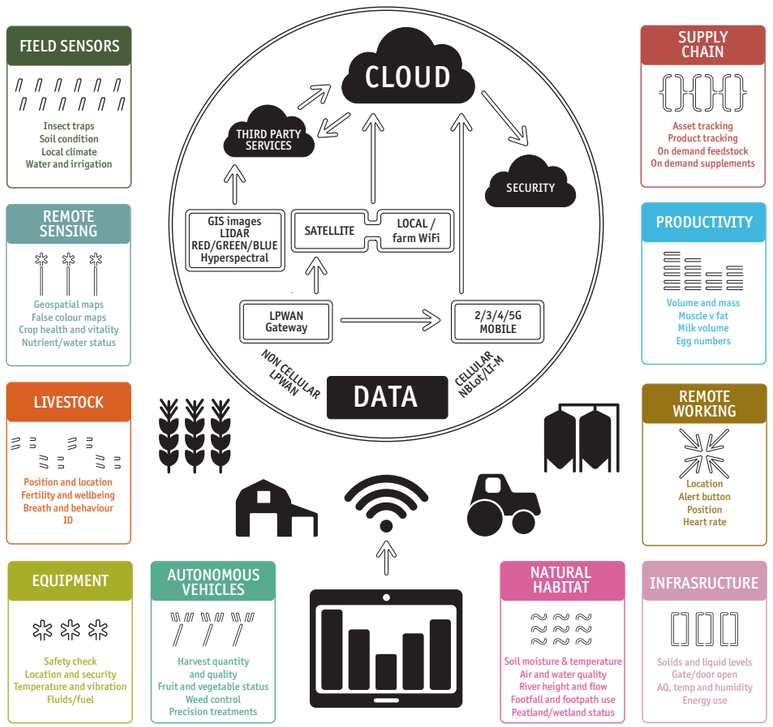
With the 'farm to fork' journey a central consideration, Professor Parr's team is working with Agri-Tech partners to increase productivity and innovation from the farm to supermarket shelves.

While we may think of the agricultural sector as dominated by traditional craft skills and intergenerational know-how, much of the business of farming has become digitalised in recent years, such that it is now commonplace for data about crops and animal health to be held securely online (a topic also covered in our next case on the sharing of animal health data).

In most instances, this data is being collated and analysed for predictive purposes, to help manage crop rotation and harvesting, or to prevent and control disease risks. Advances in digital Agri-Tech are nevertheless making new demands upon the sector, such as the need to secure data streams criss-crossing fields and farmyards from cyber-attacks or systems failures.

Ultimately, this requires increased investment in digital systems with 99.999 thresholds of reliability and accuracy that can also cope with the high volumes of real-time data, produced by interconnected systems. Opportunities to monetise this data will ensure that business models across the Agriculture and Food Systems (AFS) supply chain remain sustainable for years to come.

Digital technology in agriculture



Key advantages:

- UK Farmers are benefiting from the managed integration of data-generating technologies such as low-power Internet of Things (sensors), 4G/5G connectivity, Artificial Intelligence, Imaging, GPS, and Cloud Computing.
- Connected farm vehicles are improving safety and precision, while mobile devices and sensors are making animal tracking and monitoring much easier.
- Software is now available to help run farm production facilities, manage water /soil reserves and manage optimise crop yields.

As part of this drive for productivity through connectivity, the team at UEA are devising:

1.
Low-power-low resource sensors for edge computing.

2.
Drone platforms for imaging, search & rescue.

3.
AI and machine learning, digital twins, cloud computing and remote sensing for use in farming and food production.

These areas are increasing in capability and are directly relevant to sustaining the important Agribusiness sector across the UK.

Through our joint activities with AgriTechE, we have drawn expertise and insights from our network of stakeholders to help DIGIT Lab position honest broker advice on systems and technologies as well as provide a means of validation/testing for new sensors, networked devices and software before major investments are made across a large Agri-Tech business.

We are exploring the development of a major use case around Agri-Tech in the UK and the use of digital technologies to support business productivity and efficiency. For example, we are looking to roll out a prototypical implementation of Digital Transformation in the Agribusiness sector (crop farming) by deploying emerging technologies such as IoT, 4G/5G, Edge/Fog and Cloud Computing, as well as AI/ML and other tools, into business processes. This transformation comes with enormous benefits for business operators, investors, customers and the environment. However, the combination of these sensing, connectivity, processing and storage technologies in any deployment instance depends on the specific needs of the target organisation and their existing legacy systems, which we aim to discover using our pilot Digital Maturity/Readiness Survey.

Professor Gerard Parr
University of East Anglia

Yusuf Tukur
University of East Anglia

> "Farming has become digitalised in recent years, such that it is now commonplace for data about crops and animal health to be held securely online"

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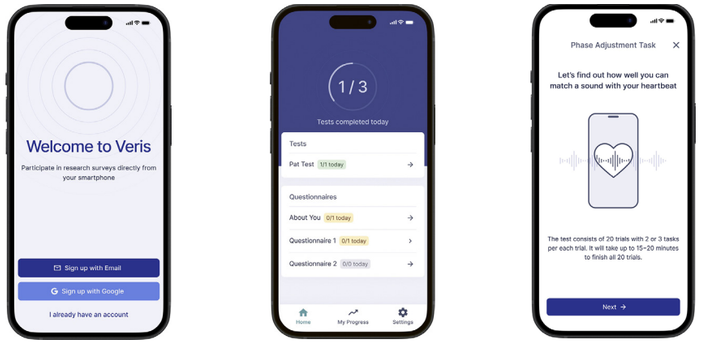
VERIS:
TRANSFORMING AUTISM DIAGNOSTICS THROUGH DIGITAL BIOMARKERS

Purpose

Smartphone applications, such as Veris, offer a scalable solution for improving mental health diagnostics, for example, in the treatment of autism. As an open-source smartphone application framework, Veris enables scientists, clinicians, and designers to create applications without the need for extensive programming skills. Designed principally to address poor mental health outcomes in England (costing £300 million in 2022), Veris aligns with the United Nations Sustainable Development Goals (UN SDGs) targeting healthier lives and wellbeing for all at all ages.



1. Voice

Following on research conducted on Healios' proprietary datasets, two voice activities designed to **mimic ADOS content** were created using DIGIT VERDIS and are currently capturing data to support model development and evaluation.

2. Eye-tracking

Used Veris to capture and evaluate **heatmap data from static photo images,** with **additional / alternative activity forms** currently in discussion.

3. Kinetics

Leveraging professional relationships with **sector-leading experts** in movement and autism research, **drawing activity** was developed to be followed by an **arm-movement activity** for autism diagnostics.

Figure 1.

Collaboration

Veris has been developed in collaboration with several stakeholders, including Healios Ltd., a UK-based company specialising in mental health and neurodevelopmental services. Healios has employed Veris to create a series of digital biomarkers for autism diagnostics. According to Dr. Sonia Ponzo, Vice President of Science at Healios, "Veris has allowed us to rapidly prototype and deploy innovative digital tools that enhance our clinical assessment processes, providing a more comprehensive understanding of autism in young people."

Mission

Veris is a cornerstone project within the Digit Lab, exemplifying the project's mission and the EPSRC's broader goals. By providing a versatile application for use in research and clinical settings, Veris enhances scientific inquiry while also delivering beneficial healthcare outcomes.

Innovation

From a technical perspective, Veris requires fewer programming skills, reducing the barriers scientists and clinicians face when seeking to prototype smartphone-based (m-health) research tools. In engineering terms, a JSON-based protocol file configures the main application, enabling rapid development without the need for advanced coding skills. Based on a modular design template, Veris supports text input, Likert scales, multiple-choice questions, and video content, incorporating novel data collection techniques, such as voice, eye tracking, and kinetics (see Figure 1).

Application in practice

- The framework's adaptability allows Veris to be used in several research contexts, from cognitive neuroscience to clinical diagnostics, thereby promoting wider participation and equality in research.
- Over half the global population have access to smartphone technology. Accordingly, Veris can be used by populations who want to volunteer in research studies remotely without entering a traditional laboratory environment.

Outcomes

- The use of Veris has yielded significant academic and applied outcomes. Academically, it has facilitated the publication of peer-reviewed research articles and the development of digital biomarker tasks, enhancing the diagnostic process for autism.
- In an applied context, Veris has been used by Healios to develop digital biomarkers that provide objective data to support decision-making. This collaboration has not only advanced scientific knowledge but also improved diagnostic accuracy and efficiency in clinical settings.
- Veris has been employed at workshops and dissemination events. These activities have involved project stakeholders and the broader research community, highlighting the framework's capabilities and benefits. For instance, Healios conducted initial testing of the digital biomarker tasks, which involved self-selecting participants and collaboration with an ASD-focused charity to research the utility of these tasks across a wider UK sample.

Veris has successfully transformed the landscape of smartphone application development for research by providing a user-friendly, open-source framework. The key outputs include the creation of digital biomarkers for autism diagnostics, enhanced research capabilities, and improved clinical outcomes.

Looking forward, the next steps involve expanding the use of Veris to other healthcare applications, further refining the digital biomarker tasks, and exploring additional collaborations to maximise its impact.

Jonathan Bird
Former Post-Doctoral Research Associate

Dr David Plans
Royal Holloway University London

"Our primary objective was to enhance the efficiency and accessibility of research tools, initially in an autism diagnostics context"

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RESPONSIBLE DIGITAL TRANSFORMATION IN ANIMAL AGRICULTURE

Overview

Farming is fast becoming digitalised. Innovations, such as the use of automated technologies and data for farm management, are designed to offset the broader challenges of climate adaptation, Net Zero and a changing agricultural labour market. While bringing many benefits, digitalisation in animal farming is altering human-animal relationships, impacting animal welfare in ways that raise questions for wider debate, of a social, ethical and political nature.

Our contribution to Work Package 4 is informed by inclusive approaches to digital transformation, founded upon the principles of Responsible Research and Innovation (RRI). With RRI as a starting point, our research project has identified proposals that will help ensure that digital technologies in animal agriculture can be developed and implemented responsibly, in ways that are inclusive of diverse stakeholders and public viewpoints, taking into account the potential future directions of digital transformation in the sector and efforts to responsibly regulate animal welfare, environmental impacts and food safety and security.

Scientists at Scotland's Rural College (SRUC) are actively involved in designing digital technologies for use in animal farming. We worked with SRUC to identify discussion materials for focus groups with a wide range of expert stakeholders in animal farming. The workshops we held in July 2023 identified their views on digital transformation in the sector. Stakeholder responses to the cases were fed back to the research team at SRUC. Focus group research indicated that agroecological farmers felt excluded from current digital technology development.

Outcomes

Our consultation dialogue identified the need for additional data governance in the livestock sector, to help manage data integration across the supply chain, with British sheep farming acting as a primary use-case for expert-led in-depth interviews, from which we obtained valuable opinion data that will help inform the better regulation of livestock data collection, processing and governance, going forward. We are currently exploring methods of engagement with sector experts and external stakeholders designed to anticipate the potential future risks and implications of livestock data use.

DIGIT & EPSRC Mandates:
Our research applies RRI to digital transformations. RRI forms one strand of Work Package 4 within Digit Lab, cross-cutting all work packages to ensure that project outcomes are delivered ethically for the social good. This also reflects UKRI and EPSRC's core commitment to RRI in their funded research.

RRI principles:
Our work has been guided by the opinions of stakeholders in animal agriculture, acquired via focus group research and interviews, from which we have identified key areas of challenge and opportunity, notably:

1.
Agroecological farmers' participation in digital technology development.

2.
The need for additional governance approaches to livestock data.

Public consultation:
To increase public awareness and participation in discussions about the digital transformations we may want to see in farming, we worked with Exeter-based filmmaker Tom Law to produce a short, accessible documentary film, *Digital Animals*, presenting four case studies of digital technology in animal farming and raising critical questions for the audience to reflect on.

Screening of the Digital Animals film at the British Science Festival, London

Activities

- The Future of Digital Technologies in Agroecology'. Workshop, University of Exeter, 16 April 2024.
- 'Responsible Innovation and Digital Transformation: Shaping Digitalisation with and for Society'. Digit Lab seminar (online), 9 July 2024. https://digit.ac.uk/seminar/responsible-innovation-and-digital-transformation-shaping-digitalisation-with-and-for-society/
- Public screening of Digital Animals, British Science Festival, London, 13 September 2024.

Summary and Next Steps

This research opens new pathways towards responsibly framed digital transformation in farming:

- Stakeholders care about the purpose, practicality and effects of digital technologies: it is essential that they be early on in the technology adoption process.
- Agroecological farming is a potentially rich locale for digital transformation, where this is informed by farming communities themselves and is supportive of their social and ethical values.
- Good quality livestock data is valued by all stakeholder groups: good governance structures are required if we are to ensure that data is used efficaciously to address major challenges in animal farming.
- We will continue to disseminate our research to expert and lay audiences through publications and film screenings.
- We expect that our research on the anticipatory governance of data in agriculture will be of wider interest to researchers, policymakers and technology developers involved in digital transformation.

Wider salience

Our research is of direct relevance to public debates about the future of food systems and animal welfare, including efforts to raise awareness of digital transformation in farming and its sociotechnical consequences, for example, by disseminating our film Digital Animals. Future work includes finalising publication of a report on digital technologies for agroecological farming.

Publications and Outputs

Williamson H., & Hartley, S. (2024). 'Responsible development of digital livestock technologies for agricultural challenges: Purpose, practicality and effects are key considerations.' *Sociologia Ruralis*, 64 (4), 662-684. https://doi.org/10.1111/soru.12492

Hartley, S., Law, T., & Williamson, H. (2024) *Digital animals.* Documentary film.

Professor Sarah Hartley
University of Exeter

Hugh Williamson
Former Post-Doctoral Research Associate

"Our work has been guided by the views and opinions of stakeholders in animal agriculture, through focus group research and interviews"

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ACCELERATING DIGITAL TRANSFORMATION:
BIM CAPABILITY ASSESSMENT, MATERIAL PASSPORTS AND DTCHATBOT

Overview

This case study aims to accelerate digital adoption and sustainable, data-driven practices by identifying organisational needs, benchmarking capabilities, and enabling traceable, interoperable workflows. Aligned with DigitLab's objectives, it integrates BIM capability assessments, Material Passport testbeds, and an LLM-based DTchatbot to transform construction and manufacturing through digital innovation and advanced data use; thereby improving decision-making, traceability, and interoperability while reducing time and cost to engage.

Partners Involved

Network Rail:
UK rail infrastructure owner/operator advancing digital readiness, BIM integration, and data-led decision-making.

Natural Building Systems (NBS):
A sustainable construction product supplier implementing Material Passport (MP)– based supply chain transparency.

LLM-based DTchatbot collaborators:
A research-led initiative developing an LLM-based chatbot to elicit digital transformation needs via workflow-driven interviews; piloted with two manufacturing SMEs.

Challenges

BIM capability assessments and Material Passports:
Digital estates are constrained by legacy/technical debt and fragmented systems with inconsistent data models; uneven standards combined with departmental silos and skills gaps hinder interoperability; and limited resources and budgets restrict digital transformation, consistency, and the ability to scale transformation.

LLM-based DTchatbot:
Traditional elicitation methods, such as workshops and interviews are inefficient, costly, and difficult to scale; surveys are low-engagement and high-effort to analyse, leading to inconsistent insights across teams and languages; organisations require structured, repeatable workflows and automated needs acquisition to facilitate successful digital transformation.

1. Select the process to assess
2. Score the performance indicators
3. Identify the performance against each BIM attribute
4. Identify the BIM capability level

Opportunities

BIM capability assessments and Material Passports:
Enable sustainability and circularity through traceability and reuse; increase productivity and supply-chain visibility; and provide scalable, repeatable frameworks that reduce time to value and prepare foundations for digital twins and automation.

LLM-based DTchatbot:
Delivers automated, structured digital needs elicitation via workflow-guided, multilingual, speech-enabled interviews; increases inclusivity and engagement; improves data quality and insight depth; provides automated consultation at lower cost to inform actionable roadmaps.

Outcomes

BIM capability assessments and Material Passports:
Established clear benchmarks of BIM capability and compliance pathways via the self-assessment toolkit; identified priority gaps and informed strategic roadmaps; demonstrated MP-enabled traceability that strengthens quality assurance and certification readiness, with projected waste reductions of up to 30% and a scalable blueprint for broader deployment.

LLM-based DTchatbot:
Ability to automatically elicit structured digital transformation needs with better consistency and depth, reducing time and cost versus traditional methods; improved accessibility through voice input and multilingual capability; pilot results validated effectiveness and defined subsequent refinements (domain tuning, multilingual robustness, analytics automation).

Overall impact:
Combining BIM capability uplift, Material Passport–driven traceability, and an AI-enabled DTchatbot creates a clear, scalable pathway for digital transformation and sustainability. Together, these digital innovations reduce time and cost to engage, improve data quality, interoperability, and traceability, and make expert consultation more accessible. This, in turn, facilitates digital transformation, informing roadmaps and laying the foundations for digital twins, automation, and future AI applications.

Recognition:
BIM capability assessments and Material Passports are shortlisted for the Knowledge Exchange Awards (Early Career Bright Future Award). Video: https://youtu.be/_mjikI9AD4Y?si=rggRDyJv5TDsyjag

Activities

BIM capability assessments and Material Passports:
Delivered a self-assessment toolkit to benchmark BIM capability and target improvements and conducted BIM capability assessments with industry partners; developed and trialled MP-based traceability testbeds with unique identifiers and physical tagging to support quality assurance, certification readiness, circularity, and waste reduction; and shared guidance to improve interoperability and scale adoption.

LLM-based DTchatbot:
Designed and implemented a workflow-guided, LLM-powered virtual expert; integrated planning /reasoning with predefined workflows and speech-to-text for natural, multilingual interactions; ran pilot consultations with SMEs and experts to test usability, adherence to workflows, and insight capture.

Publications

Yilmaz, G., Hutton, C., Valsaladas, V., Donovan, C., Zvirgzda, K., Charlson, A., Heaton, R., Suc, C., & Ahmed-Kristensen, S. (2024). Material passport for modular construction. *IET Conference Proceedings* CP885, 2024(11), 159–164. https://doi.org/10.1049/icp.2024.3501

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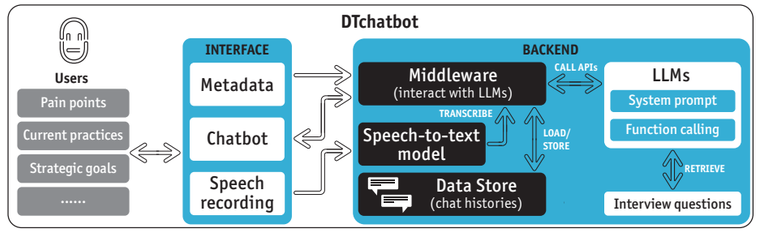

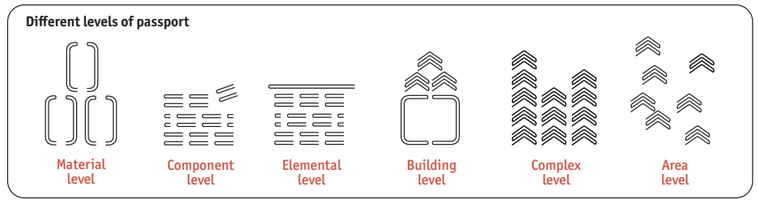

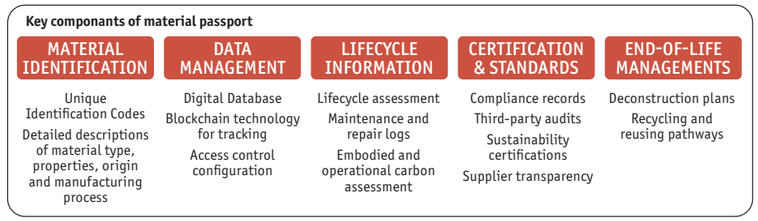

Dr. Gokcen Yilmaz
University of Exeter

Professor Saeema Ahmed-Kristensen
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Dr. Jiawei Zheng
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"From insight to impact: adopt BIM and Material Passports, and utilise an LLM-based DTchatbot to fast-track digital transformation."

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DATA-DRIVEN INNOVATION: INNOVATING PRODUCTS, SERVICES AND SYSTEMS WITH BIG DATA

Overview

With the increase in data available, from for example IoT, there has been growing interest in data-driven design and innovation over the last decade. Data-driven design implies methods, approaches and processes using data to assist the development of products and services (Lee and Ahmed-Kristensen, 2023). Yet businesses face challenges in using data as a resource for value creation and to understand how to innovate with new products, services, and user experiences that consider the needs of their stakeholders.

Based on a review of a decade of research, we developed a data-driven design framework highlighting the types of innovation that are possible with big data. We have developed and tested both the framework and data-driven innovation process through a series of workshops with a number of industry partners to test and refine our approach and explore innovation opportunities, utilising data with design approaches. These include, respectively, a partnership with See. Sense (a manufacturer of smart bike lights); collaboration with the Advanced Manufacturing ResearchCentre (AMRC) – a High Value manufacturing catapult – to test our approach with 30 UK manufacturers, and correspondingly, with 37 Companies from the Foundation Industry via Innovate UK.

This case study focuses on our work with See.Sense, a UK and Australia-based manufacturer of smart bike lights and smart bike accessories, specialising in products and data for the cycling and micromobility market. See.Sense gathers data from sensors attached to bicycles with information on traffic flow, road surface quality, and potential safety hazards. With over 120,000 sensors deployed around the world and AI-fusion technology, their mission is to make cycling safer and collectively smarter. In this context, we facilitated several workshops, leveraging data from See.Sense and beyond, to generate value for internal and external stakeholders involved in their data ecosystem.

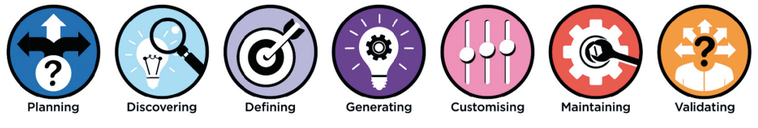
Our initial workshop with See.Sense utilised a data-driven design framework, to map all their data, before facilitating a data-driven idea generation process. A number of ideas that were generated, including innovative ideas that were new to the company, two ideas were selected to build upon further. These were: 1) encouraging people to cycle, and 2) designing and maintaining the planning infrastructure.

We invited external stakeholders and experts to attend three additional workshops, with the aim of developing detailed product and service ideas that considered both the positive and negative impacts for each stakeholder.

The first of these external-facing workshops focused upon design for behaviour change, bringing together local authorities, cycling experts, data scientists, transport and infrastructure managers, transport innovation managers, health psychologists, designers, and civil servants to understand how data can be used to promote healthy behaviours and encourage cycling. Thus, the expertise of designers, data scientists, and health psychologists were combined with insights from stakeholders.

The second and third workshops focused upon using data from bike lights to inform the planning and maintenance of cycling infrastructure, and brought together cyclists, transport and infrastructure managers, transport innovation managers, and local authorities. The third workshop in the series, is focusing upon reducing emissions, working with Dublin local authorities and businesses. Participants were able to explore how data could be utilised within their business context and gain inspiration for innovative design ideas, such as the design of data dashboards for individual users.

This case study demonstrates how real-time sensor technology can be combined with other datasets to create value and innovate across multiple business sectors, driving digital innovation.



Data-Driven framework (Lee & Ahmed-Kristensen,2025)

Challenges

The research challenge is to understand how data can be used to drive innovation by identifying the appropriate design and innovation methods to facilitate this. Industry challenges with how to create value and adopt digital technologies include:

- Identification of relevant data.
- How and when to collect and use the data.

Outcomes

- A data-driven design framework outlining key activities to drive innovation of products and services using big data.
- Data-driven process: A data-driven canvas and tools to facilitate creating value with stakeholders, which was developed, tested and evaluated as "D^3IKIT', a data-driven design process and toolkit.'

Key benefits

'D^3IKIT' enables practitioners and researchers to generate data-driven innovation.

Collaboration with See.Sense has provided the research team with a valuable opportunity to test D^3IKIT in a real-world design setting, distilling insights that will enable practitioners in different design and business contexts to realise the potential value from the data they generate. From a See.Sense perspective, the collaboration has led to novel ideas that integrate data and interest from multiple stakeholders. Two of these concepts were selected for further development, demonstrating value to the company and stakeholders, leading to a subsequent EU project, entitled SPINNOVATE, with input from Dublin City Council informing the design of data dashboards.

Key publications

Lee, B., & Ahmed-Kristensen, S. (2023). 'Four patterns of data-driven design activities in new product development.' *Proceedings of the Design Society*, *3*, 1925 – 1934. https://doi.org/10.1017/pds.2023.193

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Boyeun Lee
Former Post-Doctoral Research Associate

"We have co-created and tested the data-driven design with several companies and public sector organisation"

Partners:
See.Sense, Irene Mclesse, Philip Mclesse, AMRC High Value Manufactuing Catapult, KTP

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AI AND DESIGN CREATIVITY

Overview

Creativity plays a significant role in design and manufacturing, especially during the early stages. It is defined as “the process by which something so judged (to be creative) is produced”, which initiates innovations, assists problem-solving, and increases a firm’s market share. While a number of studies have investigated creativity in the design context, most have focused on small-scale settings, creativity still remains a notorious and elusive phenomenon. The aim of this large-scale case study is to provide a deeper understanding of the future of work for designers in a fast-changing world. The objectives of the case study involve exploring how humans perform in design creativity tasks, such as problem clarification and idea generation, compared with AI-generated results; and developing computational approaches to evaluate creativity at scale.

Who is involved

Data was collected from a broad participant pool of over 650 people to examine the impact of background and experience on creativity, including: professionals with design backgrounds, professionals without design backgrounds, students with design backgrounds, students without design backgrounds.

The case study aligns with DIGIT Lab’s research theme of Digital Innovation, investigating both the opportunities and challenges associated with adopting digital technologies, particularly generative AI, for supporting the design of products, systems and services. It contributes to DIGIT Lab’s remit of accelerating digital innovation across industries.

Challenges:

Lack of available datasets:
There is currently a lack of large and structured datasets capturing creativity, such as design requirements and ideas, produced by both humans and generative AI.

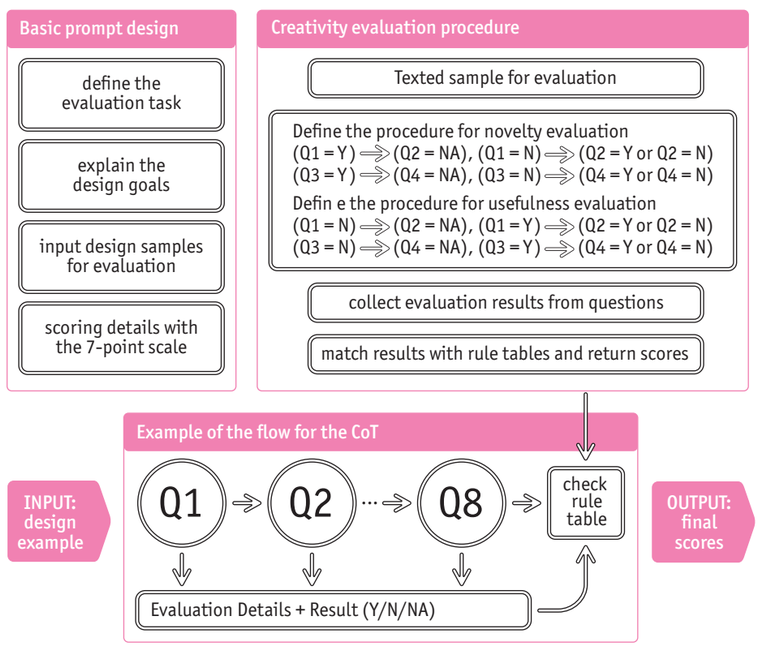
Expert creativity evaluation:
Creativity evaluation relies heavily on human expert judgements, which is particularly time-consuming and costly when assessing a large number of ideas.

Opportunities:

Automated creativity evaluation:
Developing computational methods, employing techniques such as Natural Language Processing (NLP) and Large Language Models (LLMs), to evaluate creativity at scale could enable more efficient and consistent evaluations.

AI for design:
This case study offers useful insights into where and how AI can augment and complement human creativity, informing future AI-driven design support tools.

Creativity evaluation framework using LLMs and Chain-of-Thought [2]



Outcomes:

Creativity dataset:
A large-scale dataset containing over 12,000 and 3,600 design requirements, and over 12,500 and 2,800 design ideas generated by ChatGPT and humans, respectively.

CoT for creativity evaluation:
Proposed an LLM-driven approach for design creativity evaluation, by adopting the Chain-of-Thoughts (CoT) prompting technique to enhance the evaluation reasoning capabilities of LLMs based on an existing creativity evaluation framework.

NLP for flexibility evaluation:
Developed scalable NLP techniques, both syntactical and semantical, to cluster ideas for measuring the flexibility aspects of creativity.

Activities:

Survey:
A large-scale survey study conducted to collect requirement and idea generation data generated by 680 human participants and 320 ChatGPT sessions, involving 2 familiar and 2 unfamiliar tasks.

Conference presentations:
Related work regarding the use of LLMs for creativity evaluation was presented in the International Conference on Engineering Design (ICED) 2025 and ASME 2025 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference Workshop.

Dissemination:
The survey results were disseminated as part of the AI and Design Workshop hosted at the Advanced Manufacturing Research Centre in 2024.

Summary and next steps:

This case study explores the performance of humans and AI in design creativity tasks, and their relationships, with a particular focus on problem clarification and idea generation. By collecting and analysing large-scale data from both human participants and AI, the study has contributed a large-scale dataset and introduced scalable computational methods for evaluating creativity. For the next steps, further studies will improve the reliability of the computational evaluation approaches and convert the findings into practical design support tools; the research team will engage with industry partners to explore opportunities for implementing the tools and approaches in the real world, delivering further impacts.

Publications and outputs:

Zhang, J., Han, J., & Ahmed-Kristensen, S., (2025). [1] ‘Exploring the use of LLMs to evaluate design creativity.’ *Proceedings of the International Conference on Engineering Design* (ICED) 2025.

Zhang, J., Han, J., & Ahmed-Kristensen, S., (2025). [2] ‘Chain-of-Thought for design creativity evaluation.’ *Proceedings of the ASME 2025 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference.*

Li, W.Y., Han, J., & Ahmed-Kristensen, S., (2025). [3] *LLM and human generated ideas* (dataset). University of Exeter. https://doi.org/10.24378/exe.5746

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“We have collected the largest database to date of human and AI-generated ideas, enabling a clear understanding of the role of humans and LLM in creativity.”

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A FRAMEWORK FOR DATA MOBILIZATION FOR DIGITAL TRANSFORMATION

Overview

Mobilising data is a key objective for large established firms undergoing digital transformation. These firms attempt to create value from data through platforms, connecting multiple data holders and data seekers. Much of this intermediary activity depends upon increasing volumes of users brought together by means of 'network effects.' Transaction data flowing through multisided platforms can, in theory, be repurposed to suit different types of value generation requirements, for example, marketing to new customers or maintaining customer loyalty.

Turning transactions into value-adding resources can be challenging, for example, in terms of pricing, the assignment of intellectual property rights, and privacy safeguarding. As part of their contribution to the Digit Lab project, Professor Leroy White, Dr. Dimitris Batolas, and Dr. Nikolai Kazanstev, developed an evidence-based data mobilisation framework to help businesses tackle these challenges more effectively.

This framework builds on a systematic literature review, the results of which have been combined with transferable learning from embedded case study research at a well-known agri-tech company, currently masterminding a world-first open data platform to support the animal health industry. One of the authors worked closely with the company to develop and validate the framework, based on interviews and focus groups with a cross-section of stakeholders and partners.

This case study is linked to DIGIT Lab's Work Package 3 activities, which focus on organisational structures and systems. The research team, led by Professor Leroy White, is specifically interested in addressing the challenges of mobilising data for large established firms.

Outcomes

An evidence-based framework that will help firms categorise the data-led challenges they face, principally by dividing them into two separate categories or dimensions:

Dimension 1
Focuses on mobilizing resources

Dimension 2
Concentrates on processing 'big data'

The intersection of these dimensions gives rise to four stages for data mobilisation, described below:

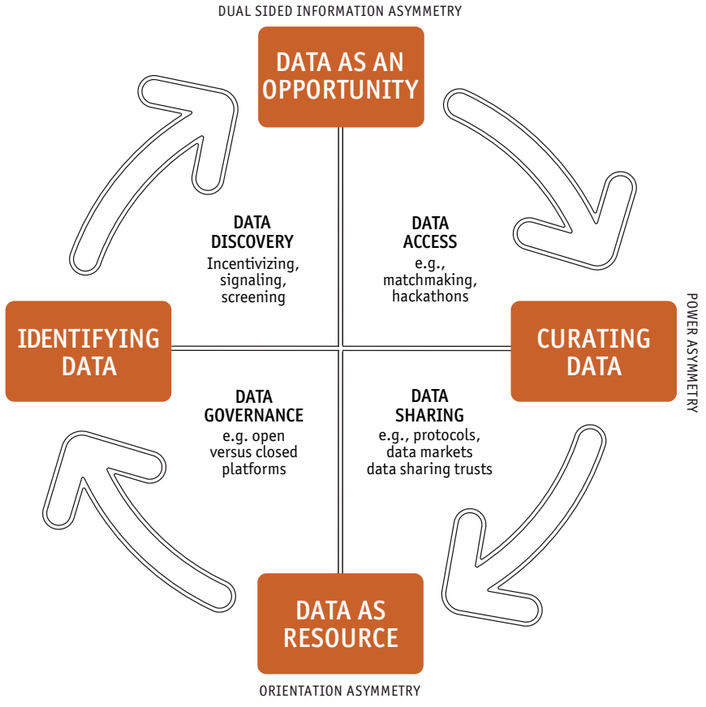
Data discovery:
Firms must focus on *screening* and *signalling*. Screening encourages due diligence behaviours on the part of data holders, while signalling encourages data seekers to identify information about the trustworthiness of data holders.

Data access:
Necessitates third-party involvement in creating trust between data seekers and data holders via hackathons and matchmaking.

Data sharing:
Once a relationship of trust has been established, data holders and data seekers look to create opportunities for data sharing. Data-sharing agreements are also important, helping to alleviate power imbalances between seekers and holders. It is here the value of the data is realized.

Data governance:
Greater trust and transparency can be mitigated by encouraging data holders to set terms for data use.

Data Mobilization Framework



Challenges and Opportunities

Data's intangible nature leads to challenges for large established firms, including:

- Data is often left underexploited.
- Industry disruption is a risk.
- Sharing data across organisational units and between firms is restricted due to privacy concerns.

Specifically, for data mobilisation via platforms, there is the problem of dual-sided information asymmetry and orientation asymmetry. Dual-sided asymmetry is where data-holders lack sufficient knowledge of data-seekers' intentions, creating a barrier to trust, while seekers are uncertain about the quality of information they are likely to receive. Orientation asymmetry arises where these incongruencies are a barrier to collaboration.

The challenge for further research is in accessing empirical case study material to understand how large, established firms can mobilise data to create value during their digital transformation. Our data mobilisation framework aims to overcome trust and information-sharing paradoxes allied to dual-sided information asymmetry and orientation asymmetry, enabling large firms to effectively mobilize and monetise data through platforms. This creates the potential for firms to enhance value creation, foster innovation, and gain competitive advantages in their industries by better leveraging data in decision-making and digital transformation initiatives.

Future Objectives

- To test and evaluate the framework with further case studies
- Explore data sharing, data privacy and data protection further in the framework.

Activities

- Engaging with organisations to road-test the framework
- Discussing with NHS leads on how the framework could be used with Electronic Patient Records (EPRs).

The first draft of the data mobilisation framework is ready to be tested. The next step is to develop a process map on how organisations can use the framework.

Key Publication

Kazantsev, N., Batolas, D., & White, L. (2024). 'Managing asymmetries for data mobilization under digital transformation.' *British Journal of Management*, 35(2), 663–678. https://doi.org/10.1111/1467-8551.12809

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"Mobilisation data from a resource to value is a challenge for large organisations. This work represents a step toward achieving that goal"

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RESEARCHER MOBILITY CASES

DR. JONATHAN BIRD

Dr. Jonathan Bird is a BASES Accredited Sport and Exercise Scientist with a specialism in psychology. His research interests span the use of digital interventions to promote physical and mental health. A large part of this work involves the use of extended reality (XR) technologies, such as virtual and augmented reality. Dr. Bird joined DIGIT Lab in 2022 to examine employee wellbeing in large established organisations and helped develop the open-source Veris application alongside Dr. David Plans. Veris has been deployed within Healios, a DIGIT Lab partner, and negotiations are currently in progress for validation pilots with NHS Trusts. Dr. Bird also worked with Professor Ilke Inceoglu on a project examining employee's experiences of the Sunday Night Blues, which refers to the feelings of worry and anxiousness on Sunday evenings in anticipation of one's impending work week. Dr. Bird's work has featured in several academic journals, such as the British Journal of Health Psychology, Scandinavian Journal of Medicine & Science in Sports, and Psychology of Sport and Exercise. Dr. Bird joined University College London in September 2024 as a Research Fellow, where he continues to develop and test a range of XR interventions to promote physical activity behaviour.

"Working within DIGIT Lab allowed me to contribute towards projects that sought to make a meaningful impact to both acadaemia and society"

DR. HUGH WILLIAMSON

Dr. Hugh Williamson trained as a Social Anthropologist and Science and Technology Studies (STS) researcher investigating governance, responsible practice and social organisation for digital technology and data in agriculture and the biosciences. Hugh joined DIGIT Lab in 2022 as a Research Fellow to work with DIGIT Lab's Co-Investigator, Prof. Sarah Hartley, on Responsible Innovation and to understand how data and digital technology are changing animal agriculture, and the impact this has on society and livestock animals themselves. His research aims to find new ways of co-producing data and digital technologies (such as digital sensing and imaging technologies) in animal farming that are inclusive of diverse stakeholders, including the perspectives of animals themselves, and are attentive to power dynamics, the uneven distribution of risks and benefits, and the environmental effects of digital systems. Together with Prof. Hartley, Hugh has published a number of papers, a framework for responsible digital technology development in agriculture, and a short documentary film called 'Digital Animals' which has been screened across the UK. Hugh has delivered seminars on Responsible Innovation and Digital Transformation as well as engaging with industry partners, stakeholders and non-governmental organisations across the agri sector.

In 2024 Dr. Williamson secured a post as a Postdoctoral Researcher within the Department of Science, Technology and Society at Technical University of Munich.

"DIGIT Lab provided me with excellent support and challenged me to take my research on digital technologies into new areas of impact and public engagement, including the opportunity to create exciting novel outputs such as documentary films"

DR. YUSUF TUKUR

Yusuf Tukur obtained a B.Sc. degree in Computer Science from Usmanu Danfodiyo University, Sokoto – Nigeria in 2008, an M.Sc. in Advanced Computer Science (Security Pathway) from The University of Manchester, United Kingdom in 2014, and a PhD in Computer Science (Internet of Things Security) from the University of Bradford, United Kingdom in 2021.

Yusuf is currently a Senior Research Associate at the School of Computing Sciences, University of East Anglia, United Kingdom, and a Researcher at DIGIT Lab. He is involved in designing DIGIT Lab's Digital Maturity Assessment Survey, which aims to understand the opportunities and barriers to digital transformation for organisations in the UK and provide expert advice on ways to improve their digital maturity posture.

His research activities also include developing a digital transformation framework to guide the deployment of IoT and AI/ML in Agribusiness for efficient digital transformation of the sector; investigating the Resilience of IoT Sensors as would be deployed in several IoT applications especially mission-critical areas that have public safety implications; and exploring the Role of Technology in attaining Environmental Sustainability.

Yusuf's research interests include IoT and its Applications, cybersecurity, Smart City Services, blockchain-IoT integration, as well as AI/ML.

"At DIGIT Lab, I had the opportunity to partake in impactful research that could help organisations to digitally transform, influence public policy and support environmental sustainability"

DR. BOYEN LEE

Boyeun Lee is a qualitative researcher specialising in design-led digital innovation, with a particular focus on big data and AI for new product and service development. Boyeun joined DIGIT Lab in June 2022 and held the position until she began her lectureship in March 2024. At DIGIT Lab, she contributed to Work Package 5 (Data-Driven Design), investigating how data can inform the design of the next generation of products and services to be human- and society-centred. Her key contributions included developing an evidence-based Data-Driven Design Framework (Lee and Ahmed-Kristensen, 2025), as well as creating Data-Driven Design Toolkits and Processes that industry practitioners can apply to generate value through data, reflecting their business challenges and opportunities (Lee and Ahmed-Kristensen, 2024).

Boyeun Lee is currently a Lecturer in Design and Innovation at the University of Exeter Business School. Her research focuses on critically examining the challenges and opportunities that arise from designing and applying emerging technologies, such as AI, Big Data, and IoT, and translating these into effective design strategies for value creation. She is particularly interested in how data and artificial intelligence can transform conventional design practices and processes to develop innovative products and services.

"Being part of DIGIT Lab has made me proud and grateful for the opportunity to work with many brilliant and inspiring academics, while also gaining a broader perspective on fostering data/AI-led design innovation"

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RESEARCH PROJECTS

Data and AI to drive innovation

The use of big data and AI to drive innovation.

- AI and Creativity: The future of work
- Data and AI in the Digital Economy
- Data-Driven Design Framework
- Data-Driven Design – See.Sense Case Study

Responsible innovation and wellbeing

The use of digital technologies to support wellbeing and responsible approaches to innovation and governance of digital transformation.

- Accelerating Digital Innovation in Animal Health at Zoetis
- Banishing the Sunday Night Blues
- Responsible digital transformation in UK animal agriculture
- 'Veris': An Open-Source Smartphone Application for Health Research and Diagnostics

Digital transformation business models

Business models for the adoption of digital technologies.

- A Business Model Innovation Tool to Understand Large Established Organisations' Digital Transformation
- Data Exchanges: challenges and opportunities
- DIGIT-BM, a digital transformation tool to help businesses to design new Business Models
- Digital transformation in Law firms Fairmiles 2.0

Digital innovation

Digital innovation – how we adopt digital technologies including AI and big data to transform products. Services, policies and systems.

- **AI and data in Design:** Advancing the design engineering processes for manufacturing sector
- **Digital Innovation:** Smart Products & Sustainability – The Role of Digital twins
- **Digital platforms:** A case study of NHS Jobs
- **Investigating the Data Reuse Problem**
- **Radical transformation in Social Housing sector:** Investigation of possibilities

Testbeds and scaling

These projects look at our Lab to LEO approach. Developing testbeds and frameworks to provide companies with insight on full scale adoption of digital technologies.

- Adopting IoT and AI Technologies for Efficient Digital Transformation in the Agribusiness Sector
- BIM capability assessment
- Digital Transformation in the Construction Industry

INDUSTRY PARTNERS

If you are interested in joining DIGIT Lab as a partner, please get in touch for further details:

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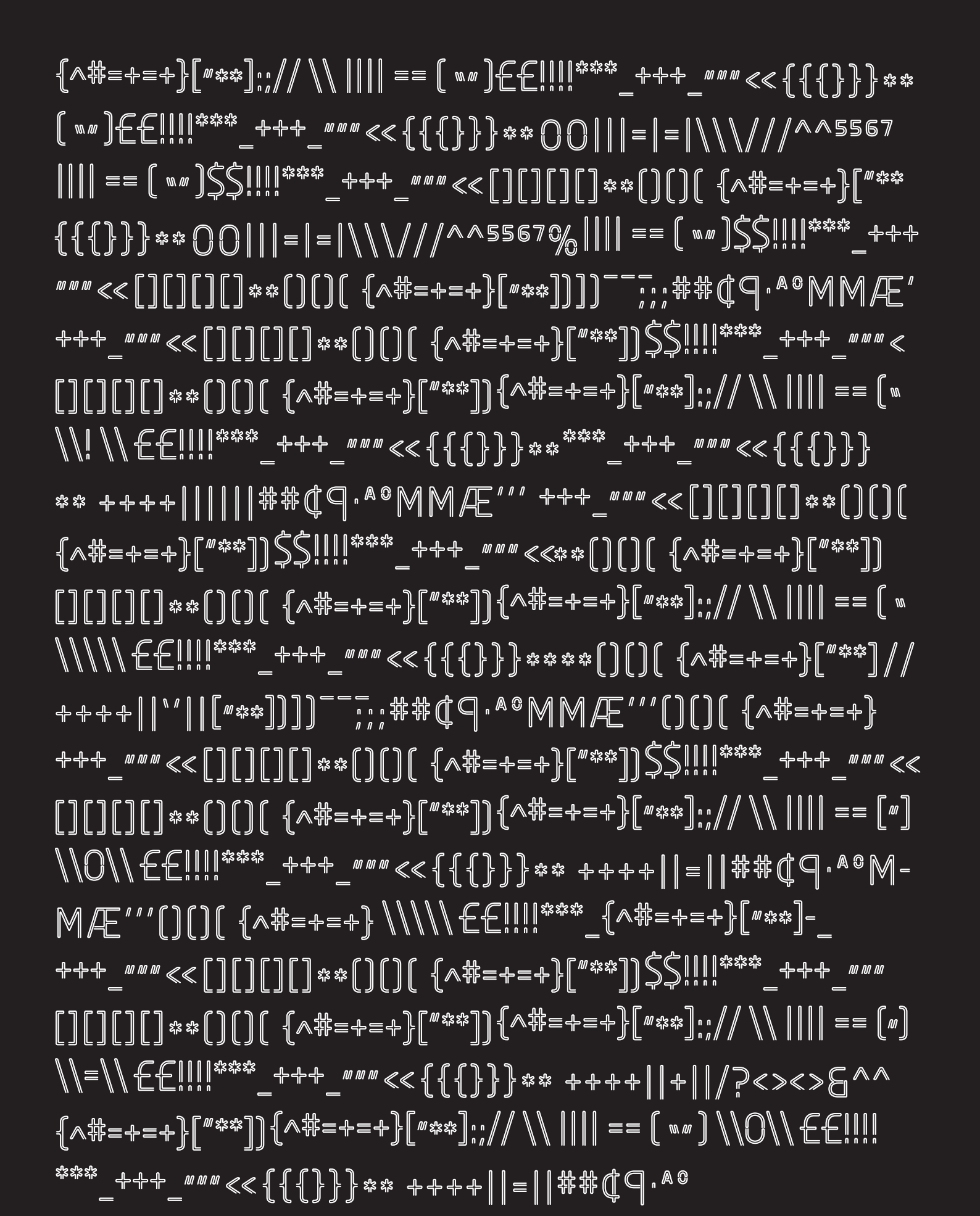

DIGIT LAB

Accelerating digital innovation for growth, impact, and transformation of large established organisations.

An EPSRC Next Stage Digital Economy Research Centre (EP/T022566/1)

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