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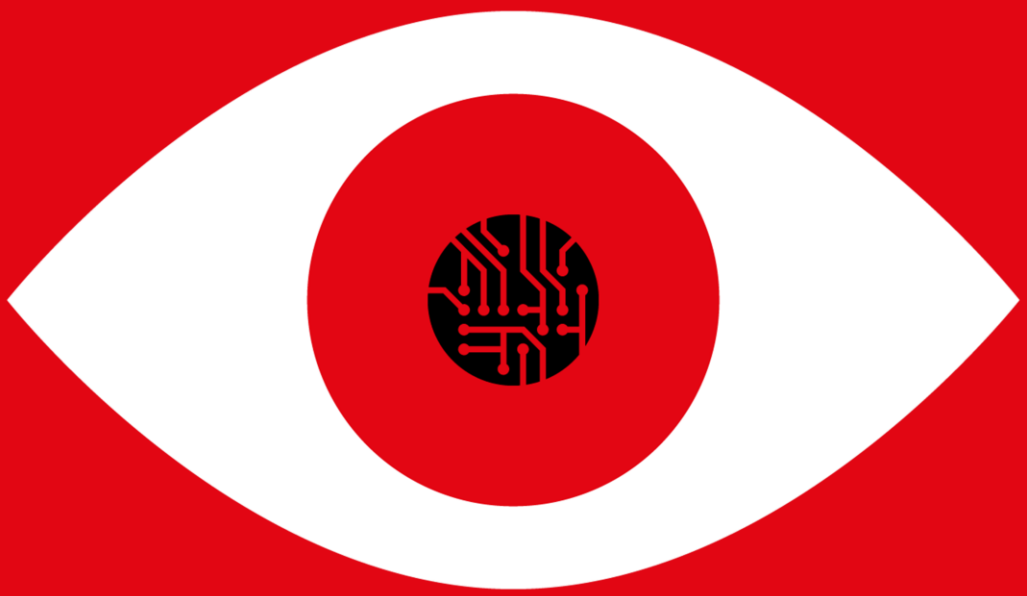
APPG AI Evidence Meeting

BIG INNOVATION CENTRE

Big Brother or Big Benefit?
Consumer Intelligence & Advanced Data Analytics

PARLIAMENTARY BRIEF



Big Brother or Big Benefit? Consumer Intelligence & Advanced Data Analytics *is a* Parliamentary Brief based upon the All-Party Parliamentary Group on Artificial Intelligence (APPG AI) Evidence Meeting held in House of Lords: Committee Room 4A on the 13th of March 2023.

This APPG AI is co-Chaired by **Stephen Metcalfe MP** and **Lord Clement-Jones CBE**.

We would like to express our appreciation to the following people for their oral evidence:

- **Gita Shivarattan,** Head of Data Protection Law Services, **EY-UK**
- **Tom Nixon,** Director of Government Practice, **Faculty**
- **Stuart Davie,** Vice President - Data Science, **Peak**
- **Vedran Podobnik,** Director - Global Lead for Data, Analytics & AI, **Hewlett Packard Enterprises**
- **Prof. Vili Lehdonvirta,** Professor of Digital Social Research, **Oxford Internet Institute**

Big Innovation Centre is the appointed Secretariat for APPG AI

- CEO, **Professor Birgitte Andersen**
- Rapporteur, **George Farrer**

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PARLIAMENTARY BRIEF

Big Brother or Big Benefit?
Consumer Intelligence & Advanced Data Analytics

All Party Parliamentary Group on
Artificial Intelligence

APPG AI Sponsors

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Contents

1. Introduction

“Big Brother or Big Benefit? Consumer Intelligence & Advanced Data Analytics”: Evidence Meeting of the All-Party Parliamentary Group on Artificial Intelligence (APPG AI) held in House of Lords: Committee Room 4A on the 13th of March 2023.

During this meeting, the focus of discussion by the APPG AI revolved around the implementation of Artificial Intelligence (AI) in consumer intelligence and advanced data analytics across various sectors, including both businesses and the public sector. The expert speakers engaged in a thorough exploration of the necessary steps to unleash the true potential of AI in this particular domain. Pertinent inquiries were raised concerning the optimisation of data utilisation rather than solely emphasising data collection, as well as addressing the challenges associated with storing vast volumes of data within the UK. Moreover, the discourse encompassed strategies for positioning the UK as a prominent player in the AI landscape, primarily by enhancing productivity and fostering innovation.

In today's digital era, discussing Artificial Intelligence for advanced data analytics and consumer intelligence is highly relevant. With the exponential growth of data and evolving consumer behaviour, leveraging AI-powered analytics becomes crucial for innovation, competitiveness, and strategic decision-making. Addressing these topics ensures responsible and ethical use of AI, fostering trust and accountability in data-driven environments.

Main questions:

- *What is the overview of the business and consumer intelligence markets with respect to using AI in business models and for risk assessments across all sectors (finance, manufacturing, technology platforms, and so forth)?*
- *How is AI applied in research and development (R&D) to stimulate business models and for risk mitigation? How does AI create information superiority and economic superiority?*
- *Is Artificial Intelligence (AI) a threat to national security, or an opportunity?*

List of panellists:

- **Gita Shivarattan,** Head of Data Protection Law Services, **EY-UK**
- **Tom Nixon,** Director of Government Practice, **Faculty**
- **Stuart Davie,** Vice President - Data Science, **Peak**
- **Vedran Podobnik,** Director - Global Lead for Data, Analytics & AI, **Hewlett Packard Enterprises**
- **Prof. Vili Lehdonvirta,** Professor of Digital Social Research, **Oxford Internet Institute**

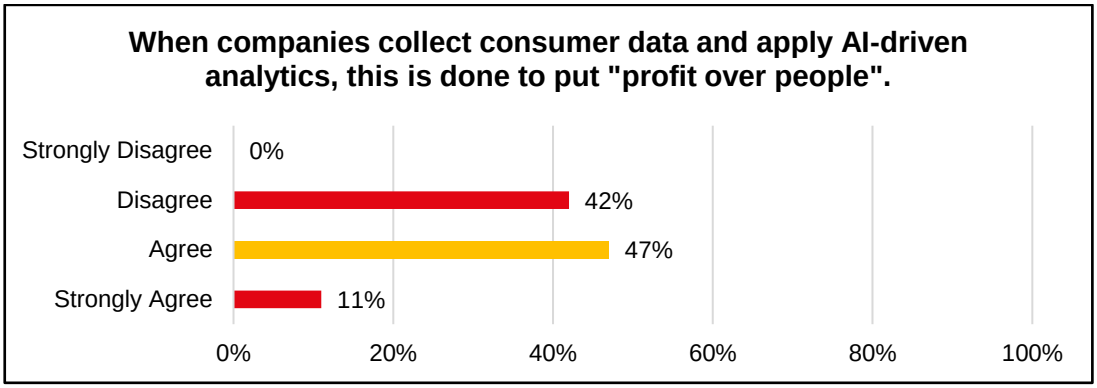
This meeting was chaired by Co-Chairs **Lord Clement-Jones CBE** and **Stephen Metcalfe MP**.

Gita Shivarattan & **Prof. Vili Lehdonvirta** gave their evidence remotely.

Parliament has appointed Big Innovation Centre as the **Secretariat of the APPG AI**, led by **Professor Birgitte Andersen (CEO)**. The Project Manager and Rapporteur for this meeting is **George Farrer**.

2. APPG AI Pavilion Survey

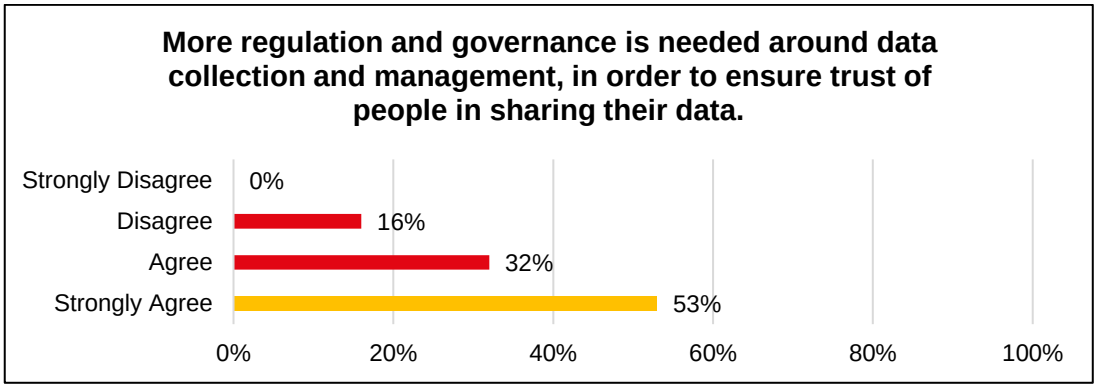
Prior to the APPG AI meeting, a survey was issued on the **APPG AI's Pavilion Platform**.



Question 1 asked APPG members whether they thought that *'when companies collect consumer data and apply AI-driven analytics, this is done to put "profit over people"'*. The results suggest that there is a significant segment of respondents (47%) who **'agree'** with the belief that when companies collect consumer data and apply AI-driven analytics, their primary focus is on maximising profits rather than prioritising the well-being of individuals. The 11% who **'strongly agree'** with the statement shows a smaller but still noteworthy subgroup that holds a firm belief in the profit-centric nature of such practices.

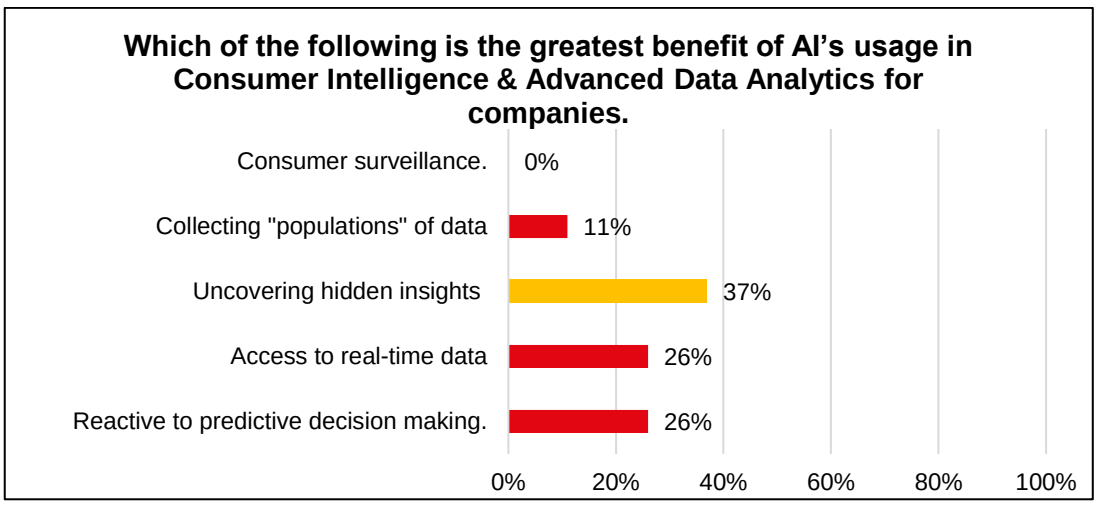
On the other hand, a notable proportion (42%) **'disagree'** with this notion, implying that they believe companies do not prioritise profit over people when utilising AI-driven analytics on consumer data.

Overall, these results reflect divergent perspectives and varying degrees of concern regarding the prioritisation of profits versus people in the context of AI-driven data analytics by companies.



Question 2 considered the extent to which members of the APPG AI Community believe *more regulation and governance is needed within data collection and management.* It is evident that a majority of respondents (53%) **'strongly agree'** that this is the case, to ensure people's trust in sharing their data. An additional 32% of respondents **'agree'** with this statement, indicating a widespread sentiment in favour of increased regulation and governance. On the other hand, a smaller proportion (16%) **'disagree'** with the notion that more regulation is necessary.

These results indicate a clear call from the majority of participants for stronger measures to be implemented to address data collection and management concerns. There is a broad consensus that trust in data sharing can be bolstered through enhanced regulations and governance.

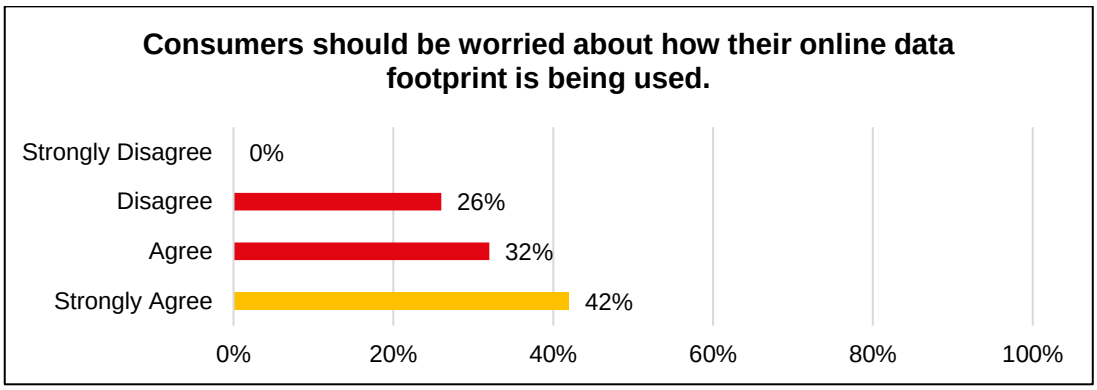


Question 3 asked respondents to identify the *greatest benefit of AI's usage in Consumer Intelligence & Advanced Data Analytics for* companies. The findings indicate that there are diverse perspectives among the participants regarding the benefits of AI in this context.

37% believe that the greatest benefit of AI in this case, is its **'ability to uncover hidden insights that human analysts may miss'**. This suggests that the utilisation of AI can assist in identifying patterns and extracting valuable insights from vast amounts of data that may be difficult for human analysts to discern.

Both **"Allowing businesses to change from reactive to predictive decision making"** and **"Access to real-time data and online signals"** received an equal share of the vote at 26%. These benefits highlight the potential for AI to enable proactive decision-making based on predictive analytics and the access to real-time data and online signals, which can provide valuable and up-to-date information for companies.

Only 11% considered **"Collecting 'populations' of data as opposed to small samples"** as the greatest benefit. Furthermore, none of the respondents selected **"Consumer surveillance"** as the greatest benefit, indicating that the surveyed individuals do not perceive this aspect as a positive outcome of AI's usage in consumer intelligence.



Question 4 asked members of the APPG AI Community about *how worried consumers should be about their online footprint.* A majority of respondents, 42%, **'strongly agree'** that consumers should be worried about how their online data footprint is being used. An additional 32% of respondents **'agree'** with this statement, indicating a significant portion who hold the belief that concern is warranted. On the other hand, 26% of respondents **'disagree'** with the notion, suggesting a minority who do not share the same level of worry.

These results indicate that a significant number of participants, 74%, express a considerable level of concern about the usage of their online data footprint. Overall, the survey results highlight a prevailing sentiment that consumers should be worried about how their online data footprint is being used. The high percentage of respondents who agree or strongly agree reflects a widespread belief in the importance of understanding and safeguarding the usage of personal online data.

3. Recommendations for policymakers

1. Policymakers should **promote the adoption of AI technologies in businesses and public services**, such as law enforcement, emphasising the importance of embedding AI into operational decision-making processes. Organisations can **leverage the available data more effectively**, leading to improved productivity and intelligent service delivery.
2. Policymakers should **emphasise the need for better scientific approaches to data analysis and utilisation**, rather than simply collecting more data. Encouraging R&D in AI technologies that can extract meaningful insights from existing data sets can **lead to better decision-making** without overwhelming businesses with unnecessary data collection efforts.
3. By fostering the responsible use of AI and promoting its adoption in public services and commercial applications**, policymakers can unlock the potential of consumer intelligence to enhance national security measures**, improve productivity, and drive innovation, ultimately securing the UK's position at the forefront of the global AI landscape.
4. Focus on **creating AI-specific regulatory frameworks**, particularly in industries such as financial services that are starting heavily to rely on AI and Machine Learning. These frameworks should address the specific risks and challenges posed by AI technologies, emphasising the need for robust governance, comprehensive risk assessment, and **effective control measures to safeguard consumers** and prevent algorithmic collusion.
5. Policymakers should **prioritise investments in research resources and infrastructure to support the development of AI technologies**. This includes establishing high-performance cloud infrastructures, independently or in collaboration with other countries, ensuring access to computing power and reduce dependence on hyperscalers. Supporting research initiatives with dedicated graphics processing unit (GPU) resources can foster innovation and promote the development of frontier AI aligned with national objectives.
6. Policymakers should champion a context-specific approach to AI regulation, differentiating between regulated and unregulated industries and use cases. By tailoring regulations to specific contexts, **policymakers can strike a balance between promoting innovation and ensuring necessary oversight** and accountability in the commercial AI sector. This approach can enhance the competitiveness of businesses while addressing potential risks associated with AI technologies.

During the discussion, there was consensus within the expert speakers that the value of AI lies not only in collecting more data but also in utilising existing consumer data, and **making sure this is 'better data' in order to enhance decision-making processes**. Expert speakers highlighted that various sectors, such as financial services, merchandising, and environmental sustainability, greatly benefit from the effective collection and utilisation of data through AI. By leveraging AI technologies, businesses can **gain valuable insights from consumer data**, leading to the development of better products and services tailored to meet consumer demands. Furthermore, AI plays a crucial role in helping businesses achieve their strategic goals, enabling them to make informed decisions and drive growth in their respective industries.

Furthermore, it was widely acknowledged that swift action is required in the field of foundational AI, along with **substantial investment in cloud infrastructure to facilitate efficient data collection**. Such initiatives are vital in enabling the generation of new insights that can drive innovation and bolster economic growth. However, the expert speakers made sure that it was important to note that these endeavours come with considerable expenses. A small number of major global companies dominate the cloud infrastructure space, making it a costly endeavour for smaller organisations to acquire and maintain the necessary resources. Additionally, there are concerns surrounding the environmental impact of this technology due to its substantial energy consumption.

Tom Nixon, Director of Government Practice at **Faculty**[1], acknowledges that there has been a 50-fold increase in data over the past decade. However, he highlights the lack of improved decision-making despite this abundance of data. Nixon argues that **organisations are overwhelmed by excessive data**, leading to ineffective business dashboards that may hinder decision-making. Instead, he advocates for the **integration of AI into operational decision-making** and key business processes as a more impactful approach.

In their collaboration with UK law enforcement, Nixon states that Faculty successfully implemented AI to improve the triage process for serious crime cases. By gaining a deep understanding of the officers' workflow, they developed a straightforward AI tool that automatically assessed case referrals for potential risks. This tool prioritised referrals and provided guidance on relevant sections within extensive materials, resulting in a significant reduction in case processing time. As a result, more victims and perpetrators were identified without the need for additional data collection. This approach holds promise for various sectors, including government agencies, as it **addresses productivity challenges** and enables the development of intelligent and responsive services.

Finally, Nixon states that the UK must act swiftly to compete internationally in foundational AI amidst rapid progress in Large Language Models (LLM) and the dominance of US mega-labs. Despite limited venture funding, the UK possesses world-leading data assets to train a sovereign LLM. Faculty strongly supports this initiative, envisioning a foundational model trained on the UK's national archives, British Library, and scientific publishing base. Such

[1] **Faculty.** https://faculty.ai/

efforts unlock opportunities for sensitive government use cases and the export of "trustworthy" LLMs trained on high-quality datasets.

Commencing her evidence, Gita Shivarattan, Head of Data Protection Law Services at **EY UK**[2], sheds light on the current state of the financial services sector, highlighting its global leadership in digitisation. However, she notes that the sector faces increasing demands to streamline operations, foster innovation, and maintain transparency. To meet these challenges, Shivarattan emphasises the **indispensable role of AI and Machine Learning in driving the decision-making processes within financial services**. By harnessing these technologies, organisations can deliver enhanced products and services to consumers, while simultaneously optimising operational efficiency and augmenting revenue streams.

However, Shivarattan delves into the emerging risks associated with AI in the financial sector. These risks encompass shared third-party algorithms, unintended consequences, operational resilience, and the utilisation of non-traditional datasets. While ensuring that data accurately represents real-world scenarios in which AI is applied, the **growing reliance on non-traditional datasets, such as social media, to customise financial products raises concerns among customers due to perceived intrusiveness**. Furthermore, there is a potential for unintended consequences that could impinge on individuals' freedom to express ideas on matters that may impact their financial well-being. It is crucial to navigate these risks carefully and strike a balance between leveraging AI's potential and safeguarding consumer rights and privacy.

Finally, Shivarattan underscores the **long-standing objective of regulators to foster resilience in the financial system.** AI introduces three key challenges to operational resilience: the risk of third-party failure, complexities in system substitution, and the increased vulnerability to data breaches due to the processing of extensive datasets. Addressing these challenges is essential for building a robust and secure financial ecosystem.

Vedran Podobnik, Global Lead for Data, Analytics & AI at **Hewlett Packard Enterprises (HPE)**[3], starts by highlighting the purpose behind companies collecting and acquiring consumer data. Their **primary objective is to enhance the customer experience by delivering a seamless and personalised service**, departing from the traditional one-size-fits-all approach. Podobnik specifically references online retailers as an example, emphasising that they rely on extensive data collection, including historical purchase data and non-traditional contextual information, to optimise the customer experience. This **data-driven approach enables companies to offer tailored and highly relevant services to their customers**, resulting in a more satisfying and individualised customer journey.

[2] **EY UK.** https://www.ey.com/en_uk
[3] **Hewlett Packard Enterprise.** https://www.hpe.com/uk/en/home.html

Figure 1: Consumer Intelligence & Advanced Data Analytics - what is important to consider?

Moreover, Podobnik explains that companies leverage data to drive revenue growth and improve cost efficiency**. By utilising and analysing data, companies strive to enhance sales and improve service efficiency from a cost standpoint.** A newer business objective is to support environment, social and governance (ESG) targets by quantifying the sustainability benefits of digital transformation. For instance, **ChatGPT**[4] **is utilised by many companies to advance their operations**, but training such technologies requires extensive datasets, which is costly from a monetary and energy perspective.

Concluding his remarks, Podobnik asserts that the **advantages of data access and leveraging advanced analytics to generate valuable insights far outweigh the associated risks**. Nevertheless, he emphasises the importance of understanding and managing these risks to foster consumer awareness and ensure effective governance. Podobnik concludes by underlining the necessity of regulation in this context.

Stuart Davie, the Vice President of Data Science at **Peak**[5], emphasises the significance of commercial AI, highlighting its ability to address the diverse challenges faced by businesses, ranging from skills and customer-related issues to overall goals. **AI possesses the capacity to accommodate and adapt to these variations effectively**. Furthermore, Davie argues that AI plays a crucial role in enabling informed decision-making by leveraging the wealth of available information. With its ability to identify patterns at a larger scale and generate predictions beyond human capabilities, **AI proves exceptionally valuable in various commercial contexts**. While human decision-making remains essential, AI serves as a valuable tool to enhance revenues, profits, and overall operational efficiency.

Davie then goes on to give the example of merchandising, as somewhere where Peak is

[4] **ChatGPT.** https://chat.openai.com/
[5] **Peak.** https://peak.ai/

applying AI and having an impact. Merchandising teams in retail have the critical responsibility of managing stock levels to prevent sales loss and excess inventory. Even in smaller businesses, these teams face a significant number of decisions each year. To make informed choices, they consider factors like current stock levels, sales data, seasonal trends, and market positioning. However, the common tendency to focus on the best-selling and worst-selling products neglects the middle 80%, leading to inefficiencies such as overstocking and poor availability. **Commercial AI offers a solution by streamlining the merchandising process** and optimising decision-making.

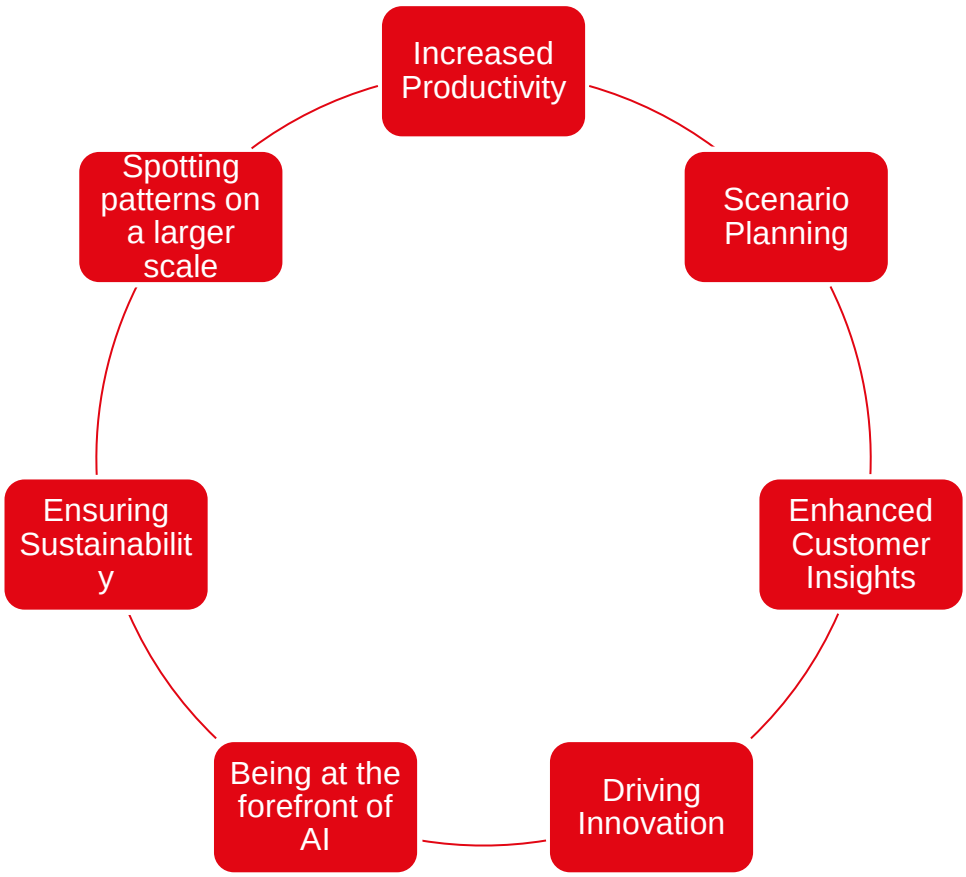


Figure 2: Benefits of using AI for Consumer Intelligence & Advanced Data Analytics

Davie finishes his evidence by emphasising the importance of perceiving AI as an opportunity to establish a stable and sustainable business, rather than a threat. **He advocates for a context-specific regulatory approach** that strikes a balance between ensuring accountability and promoting innovation. According to Davie, a light-touch regulatory framework for commercial AI would foster increased innovation and enhance its applicability for businesses in the UK.

Professor Vili Lehdonvirta, Professor of Digital Social Research at the **Oxford Internet Institute**[6], highlights the geopolitical implications of the significant physical infrastructure

[6] **Oxford Internet Institute.** https://www.oii.ox.ac.uk/

necessary for operating cutting-edge AI technologies. He emphasises the **need for parallel collaboration among frontier AI developers**. However, the concentration of thousands of GPUs is predominantly found in hyperscale data centres owned by tech giants such as Amazon, Google, and Microsoft[7]. Consequently, as AI research labs expand and require more computational resources, they are increasingly drawn towards relying on these hyperscalers, as seen with **DeepMind**[8] and **Athropic**[9] joining Google and **OpenAI** aligning with Microsoft[10]. **This growing dependence on infrastructures owned by a limited number of corporations raises concerns** for Prof. Lehdonvirta regarding the ability to shape the development of AI in line with UK values and objectives as AI becomes more prevalent.

Professor Lehdonvirta highlights the **need for a UK sovereign high-performance cloud infrastructure**, a proposition echoed by numerous experts. However, he notes that previous attempts by nations like France and Germany have struggled to achieve success due to the scale required to make such a project viable. To ensure the success of a UK sovereign cloud, Prof. Lehdonvirta proposes two potential paths. The first involves collaboration with other countries to achieve the critical mass necessary for sustaining a cutting-edge cloud infrastructure under public ownership. Alternatively, the UK could intensify its reliance on US hyperscalers while actively managing the associated political dependencies. These strategic approaches offer potential avenues for establishing a robust UK sovereign cloud infrastructure.

[7] **'Where are the hyperscale cloud providers building their data centres?'** (26 June, 2022) https://techmonitor.ai/technology/cloud/where-cloud-providers-building-data-centres
[8] **Deepmind.** https://www.deepmind.com/
[9] **Anthropic.** https://www.anthropic.com/
[10] **'Open AI & Microsoft Extend Partnership'**. https://openai.com/blog/openai-and-microsoft-extend-partnership

4. Evidence statements

Tom Nixon, Head of Government Practice, Faculty

To introduce myself, I work for **Faculty**, an applied AI firm leading our work across government. We've been going since 2014 and have built over 100 live AI systems across most areas of the economy.

How is AI being used to make business models more effective?

There's been a lot of hype over AI over the last few years, and an awful lot of investment by both Government and the private sector in data transformation.

Gartner has found that organisations today have 50 times more data than 10 years ago on average, but two thirds of leaders say that hasn't translated into better decision making[11]. In fact, too many organisations are swimming in data they don't know what to do with, with endless business intelligence (BI) dashboards that get ignored at best, or at worst actually confuse people and make decision making worse.

So, cutting through this, through countless projects in both the public and private sector, we've found the critical thing is not to focus on collecting more and more data, but to embed AI into operational decision making and key business processes. I wanted to unpack this with quite a

[11] Gartner - **'How to Make Better Business Decisions'** (October, 2021). https://www.gartner.com/smarterwithgartner/how-to-make-better-business-decisions

simple, but really important public sector example.

Over the last few years, we've helped UK law enforcement use AI to improve how they triage serious crime cases. From speaking directly with officers, we found that what they needed wasn't some cutting-edge or particularly complex AI, even if they may have wanted to build it, but something that embedded directly into their decision making flow. Specifically, they typically received 100s of referrals a week on these crime cases, far more than they could deal with. They were having to open each referral in turn, and then for each one review 100s of pages of upsetting material manually to decide if they needed to investigate further.

So by understanding their decision making flow - we were able to build a comparatively simple AI tool which reviews each referral automatically and assessed each one for potential risk - did it have particular threat keywords or was a victim or perpetrator named, for example. This allowed us to automatically prioritise which referrals officers should look at first - and also flag to them where in the 100s of pages of material to look. This has reduced the amount of time to process cases by about 5-fold, meaning more victims and perpetrators identified, and crucially without needing any extra data collection.

We think it's a neat example as this exact same challenge - triaging operational case work - is replicated and has relevance right across the public sector, Government, and even the wider economy. So, processing passport applications, or welfare claims, or prioritising the workload of tax inspectors, among many others. Normally, there is often too much demand for the civil servants to deal with.

This sort of comparatively simple AI - if deployed properly into decision making, can help address the productivity challenge today and also allow us to build more intelligent and responsive public services.

How will R&D in AI stimulate new business models?

So, in the previous example, the decision-making flow is relatively simple, an officer is deciding whether to proceed with a case or not.

But a key new research field is embedding AI into more complex systems, and hence more complex decision making. A famous example is Formula1, and very complex, closed decision-making systems. This fundamentally involves being able to do scenario planning, being able to model uncertainty, and being able to understand causality.

Over the last few months, we've been helping the Welsh NHS to improve its discharge planning to help get adults out of hospital more quickly, ground-breaking work which has received lots of positive media coverage and was referenced in the House of Lords. Modelling this is incredibly complex - you have to model uncertain parameters such as inflow of patients; key clinical making processes, the interaction with other organisations such as social care, and decisions naturally have lots of two-way causality.

To make optimal decisions, you really need to be able to model forwards what might happen, not just look backwards at what happened in the past. This doesn't necessarily need lots more data. It requires good science, applied to that data.

We've been developing a product called **Frontier**[12] which attempts to create a 'computational twin' of a hospital or other complex system - all building on an emerging R&D field within AI called causal modelling. This technology should have applicability to lots of complex business systems - e.g., we're currently using it to model military bases for Ministry of Defence, or to help companies optimise their supply chains.

Large Language Models (LLMs)

Today (13th March 2023), Faculty have just announced a partnership with OpenAI[13]. We are going to be their first integrators to help bring technical systems use OpenAI's tools at scale.

Over the next few months, we expect to see a sort of 'Cambrian explosion'[14] of innovation in this area - not just in LLMs themselves, but also in how to apply LLMs into existing business models and operational use.

Everyone has seen their impressive text and image generation power, but a really big question is how much and how quickly can they disrupt established business models and existing day to day processes. They have also shown incredible potential at text summarisation, at search and discovery, at turning unstructured data into structured data, and even things like writing code.

So, over the next few months, we're likely to see many different use cases of LLMs across things like customer service, automated correspondence, enterprise search, and many more.

And in terms of operational use of LLMs, we think key technical R&D will come in how you best connect LLMs to in-house datasets, and also how you make the technology 'safe'.

So, for example, many large corporates - and government departments - could potentially use LLMs for correspondence drafting or complaints handling. But rather than use **ChatGPT** - which is a generic model which often gives plausible but generic response - how could you 'tune' the underlying model to learn from a corpus of ground-truth, such as that organisation's terms and conditions? How do you get it to learn the 'house' style? And how do you make sure the model isn't biased and you can verify quickly when it's giving wrong answers?

These are some of the key questions which will be the focus of applied R&D

[12] **Frontier**. https://faculty.ai/frontier/
[13] Faculty – **'OpenAI asks Faculty to help businesses adopt generative AI'** (March, 2023) https://faculty.ai/blog/openai-asks-faculty-to-help-businesses-adopt-generative-ai/
[14] The phrase "Cambrian explosion" is used metaphorically to describe an expected rapid and diverse innovation in the application of LLMs in business models and operations.

The potential for AI to give Information superiority and economic superiority

We've arguably seen that with cloud, the UK was effectively too slow to the party to compete. We've given away our ability to complete in big tech and the cloud.

With the rapid progress in LLMs, and the big mega-labs in the US, we're arguably at a key moment where we need to act fast if the UK is to be genuinely internationally competitive on foundational AI. We need to be smarter and utilise the strengths we do have. We may not have the deep venture pockets, like the US, but we have other things to our advantage.

The UK has some of the genuinely world leading data assets which to train a genuine sovereign LLM, which over the last few weeks, the likes of William Hague, Tony Blair, and the Turing Institute have been calling for[15]. As Faculty are on the inside of the tech and seeing how the models get built, we really support that. For example, imagine a foundational model trained on the whole of the UK national archives, the British Library, and our scientific publishing base.

And doing so could unlock major opportunities: both so that this AI can be applied to the most sensitive government use cases, and also to give us an export market in building 'trustworthy' LLMs, trained on the best big data sets.

Is AI a threat to national security, or an opportunity?

Finally, turning to the question of whether AI is a threat to national security, or an opportunity - the quick answer is it must be both.

We have seen how bad actors have used AI systems to propagate harm online at scale, for example to spread Russia/Ukraine disinformation in the last year[16]. Or as a specific example, in the wake of the awful Christchurch terror attack of 2019, how extreme right-wing groups used AI to manipulate the attack video to avoid content moderation systems and spread it across the internet[17].

Also, just as there's going to be an explosion of positive innovation following the widespread availability of LLMs, unfortunately we're also going to see an explosion of people using it for harm.

So just like our adversaries are using AI to propagate harm, AI also needs to be part of the solution. In the last year, as Faculty we've been building the cross-Government Counter

[15] Tony Blair & William Hague - **'A New National Purpose: AI Promises a World-Leading Future of Britain'** (June, 2023). https://www.institute.global/insights/politics-and-governance/new-national-purpose-ai-promises-world-leading-future-of-britain

[16] **AI & Disinformation in the Russia-Ukraine War.** https://www.techtarget.com/searchenterpriseai/feature/AI-and-disinformation-in-the-Russia-Ukraine-war

[17] **The New Zealand Attack and the Global Challenge of Far-Right Extremism**. https://www.csis.org/analysis/new-zealand-attack-and-global-challenge-far-right-extremism

Disinformation Platform, using national language processing technology to spot disinformation and how it is spreading, allowing government to prepare counter-narratives.

We've also been working with the **Global Internet Forum to Counter Terrorism**[18] - a industry grouping of the online platforms - to deploy AI classifiers to detect terrorist content and get it taken down more quickly.

And in Government at the moment, we have a project trialling the use of LLMs to support intelligence analysis - which has transformative potential.

[18] **Global Internet Forum to Counterterrorism.** https://gifct.org/

Gita Shivarattan, Head of Data Protection Law Services, EY-UK

I'm a partner at **EY**, and I head the Data Protection Law Practice for financial services. I've been focusing on data protection in financial services for the last 15 years, and over the last five years, focused on the adoption of emerging technologies in financial services and compliance with data protection frameworks.

Today I'm going to share my views with you on three emerging risks firms are facing around the adoption of AI in consumer markets. The views I'm going to share today are my personal views and not those of my firm.

AI in Financial Services

Financial services, as we know, as a sector is probably the most digitised globally, and indeed the most datafied. I think other than getting cash out of the machine, which is increasingly becoming less frequent, financial services is all about spreadsheets and data. As a sector, it is increasingly under pressure to become more efficient, to innovate, to be creative whilst maintaining transparency and accountability of processes and decision making. AI and Machine Learning capabilities are indeed key parts of decision-making processes in financial services.

There are plenty of use cases of AI used across the financial services sector already such as:

- Credit decisioning, including credit scoring and lending.
- Risk management processes, including fraud detection and prevention.
- Investment management use cases such as Machine Learning technologies to coordinate trading decisions.
- Process automation.

I think given the long history of primarily data analytics in this sector, financial services is increasingly primed to take advantage of AI and offer better products and services for consumers, increase operational efficiency, increase revenue, and drive innovation. All of which may lead to better outcomes for consumers, firms, financial markets, and the wider economy.

It's not just the sector, however, that's focused on leveraging data in this way. Financial services regulators such as the **Financial Conduct Authority (FCA)**[19] and the **Prudential Regulation Authority (PRA)**[20] also have expectations on firms to increasingly be more data driven in their decisions and to look and leverage data as part of the regulatory agenda. A recent example of regulation being consumer duty. This is a new regulation which has come out really almost requiring financial services, to collect more data about individuals, to assess the suitability of products and services. That's a real shift in the expectation from the regulators of how financial services are using firms. At its heart, the overarching principle is the use of technology and data to support an ethics compliance in the space.

In absence of an AI specific regime, firms are required to assess a myriad of existing technology neutral frameworks to assess risk and implement the perfect governance and control. Over the past five years, we've really seen a convergence of financial regulation, data regulation and competition regulation to define an AI compliance framework with data protection.

It follows that my view is that an understanding of the wider risks of automation and implementing these technologies in specific use cases is required, and a generalist approach to risk assessments is unlikely to appropriately identify novel risks introduced in these use cases.

New Risks Driven by AI

So, I want to talk about three new risks, which are driven by AI and related changes, to consider.

- Increased data collection and the ability to access non-traditional datasets.
- Shared third party algorithms and unintended consequences.
- Impact from operational resilience in respect to financial services.

Non-Traditional Datasets

Looking first at non-traditional datasets for any successful project, sufficiently high quality, well formatted data is required – we've heard that many times in this forum. Importantly, we know that data should be properly representative of the real-world situations in which the AI would

[19] **Financial Conduct Authority (FCA).** https://www.fca.org.uk/
[20] **Prudential Regulation Authority (PRA).** https://www.bankofengland.co.uk/prudential-regulation

be used. It should be checked carefully to ensure it does not embed biases and discrimination.

In the digital economy, there's an increasing interest from firms to use non-traditional datasets, such as the use of social media for other publicly available profiles and information; to tailor financial products; and the ethics of using non-traditional datasets are increasingly under scrutiny. Not only is it likely to be seen as intrusive and unacceptable by customers, but it could also have unintended consequences and impacts such as, for example, curtailing an individual's ability to freely express ideas on issues which may negatively impact their financial status or rating. Or conversely, it also creates the risk of financial exclusion for customers who do not have an online presence.

Shared Availability of Third-Party Tools & Services

Second, the shared availability of third-party tools and services, particularly commoditised AI services, has spurred the adoption of AI in many models. Implementation of these solutions across the sector, with multiple industry players relying on the same algorithm to facilitate information sharing, known as hub and spoke models, may result in algorithmic collusion. This is particularly relevant in pricing information for either the model managers discounts or price caps or provides competitors with the ability to monitor prices and thereby determining market prices, which introduces anti-trust issues.

Operational Resilience

Finally, I want to talk about operational resilience. So, building resilience into the financial system has been a long-standing aim for regulators globally. Recently, there's been a push by regulators to focus more attention on cyber security and operational resilience. Operational resilience involves preparing for disruption in the broadest sense, caused by, for example, a cyber breach or a personal data breach, or a failure of a third-party service provider. There's been a shift in regulatory focus saying, ‘look, we're not trying to prevent it. We're now trying to say, what do we do when it happens? Because it's an inevitability.’

There are really three key challenges introduced by an AI in operational resilience:

- Third party failure.
- Challenge to substituting systems.
- The big data challenge.

In many cases, financial services institutions will not develop their own AI, but instead will work with technology companies and other third-party service providers. If any of their critical systems are reliant on that third party provider, failure of that provider is a key threat. From a regulator’s perspective, this risk is amplified if there's a concentration in the market around a small number of providers, especially if those providers are unregulated and are not subject to direct supervision.

We can see this as an increase in challenges in substituting the systems and AI systems as they operate in a repeat for black box environments. Also because of IP protection reasons, you may not necessarily have full transparency into the underlying code. This may result in a system failure or black swan event that makes it exceedingly difficult to maintain business continuity. Finally, the big data challenge. The more data we process, the greater risk of the data breach.

Whilst none of the foregoing are indeed showstoppers, they do represent unique issues presented by a digital transformation and the digital economy. Which do need to be included in part of the risk assessment and mitigation plans as AI solutions are more readily available and adopted into systems.

Vedran Podobnik, Director - Global Lead for Data, Analytics & AI, Hewlett Packard Enterprises

Introductory Remarks

I'm the Global Lead for Data, Analytics & AI at **Hewlett Packard Enterprise (HPE)**, one of the leading information technology companies in the world. Also, I'm a Professor of Data Science at the **University of Zagreb, Faculty of Electrical Engineering and Computing**[21], Croatia. I hold PhD (Computer Science) and MSc (ICT) from the University of Zagreb, Croatia, as well as an MPhil (Technology Policy) from the University of Cambridge, UK.

I approach this topic with two hats. Data analytics and AI, as well as technology and innovation management, are the focus of my industry and academic interests and responsibilities. I'm excited to share my perspective on the opportunities and risks of applying advanced data analytics and AI to consumer data.

Why do Companies Collect Consumer Data?

Let's start with why. Why do companies collect (or even buy) consumer data and subsequently analyse it using various advanced analytics or AI-based methods? My view is that there are two main reasons:

- They want to provide a better customer experience to its consumers.
- They want to achieve or overachieve their business goals.

Customer Experience

[21] **University of Zagreb Faculty of Electrical Engineering & Computing.** https://www.fer.unizg.hr/en

If we focus on customer experience, let's think how companies can make customers happy. They can boost customer experience by providing seamless personalised service to them. This is the opposite compared to the traditional way of service providing where service providers used the "same service fits all" approach. For example, think about the online retailer. An optimal shopping scenario from the consumer perspective would be that immediately after you visit an online retailer's web shop, your shopping bag already has a recommendation for items you want to buy. Seamless and personalised for you. Or even better, online retailers wouldn't wait for you to visit their website but would inform you when and what you need to buy – powerful. Online retailers cannot achieve such customer experience without collecting lots of data about their customers, their historical purchases and other non-traditional data which explains contextual information connected with age, location, social media activities and similar.

Using Data to Achieve Business Goals

A typical business goal is to increase company revenues and profits. This means companies are using and analysing consumer data to sell more (either by winning new consumers or creating new markets) and provide services more efficiently from the cost perspective. This, for sure is happening and we cannot neglect that.

However, we are also seeing a trend that additional business goals companies need to accomplish emerge, such as contributing towards ESG targets. I can give a first-hand example of my company, HPE, where we are heavily investing in both "sustainable IT", as well as "IT for sustainability". In both those areas, the decisions we are making are heavily data-driven, and we wouldn't be able to help our customers to quantify sustainability benefits of their digital transformation journeys without having access to lots of their data (as well as data from the broader market to be able to baseline).

In order to quantify the positive effect of digital transformation, you need to collect the data about the beginning of the journey, collect data about the end of the journey and compare. Moreover, we also need to connect the data with the data about the competitiveness of the markets, because then you enable them to compare them to the market and showcase that they are leading from the sustainability perspective or not.

Think for example about Generative AI, a technology whose potential some compare with the impact that the invention of the Internet and world wide web had on societies and businesses. Training Generative AI technologies such as **ChatGPT** cannot be done without having access to vast amounts of data. It is also very expensive from a money and energy consumption perspective; therefore, you need to invest huge sums on supercomputer infrastructure, and pay a huge energy bill to train the models. If it would be able to achieve the same or similar outcome from the Generative AI model perspective by using 20% more data and 80% fewer training cycles (and consequently 80% less energy), would that be a responsible thing to do from the ESG goals perspective?

Concluding Remarks

From my reflection, it's apparent that I believe that the benefits of having access to data and using advanced analytics and AI to create new insights outweigh the risks. However, risk must be well understood, soundly documented to enable consumer awareness, and properly managed and governed. This is where regulation becomes so essential, and it's great that we are all here talking about this topic in the UK Parliament.

In HPE, we recognised the critical need to govern the risk related to all AI-related projects we do internally and for our customers. This is why we established the "AI Ethics Advisory Board" and "AI Ethics Working Group" in 2020[22]. The "AI Ethics Advisory Board" is a pan-HPE group of leaders to provide oversight and make decisions that bridge the business and ethical considerations of AI. The "AI Ethics Working Group" is an operational group of experts who develop standards, guidance, and systems for preventing unethical outcomes and assess and advise on the AI we create. Both groups are led by five ethical principles that guide HPE's use and development of AI:

- Privacy-enabled and Secure.
- Human-focused.
- Inclusive.
- Responsible.
- Robust.

[22] Hewlett Packard Enterprise – **'AI ethics: the moral and ethical implications of using Artificial Intelligence'** (April, 2022). https://community.hpe.com/t5/tech-insights/ai-ethics-the-moral-and-ethical-implications-of-using-artificial/ba-p/7163353

Stuart Davie, Vice President - Data Science, Peak

Introductory Remarks

I'm VP of Data Science at **Peak**. Peak's, a UK founded AI company that provides businesses with the platform, the applications and the services required to harness the power of AI to increase their efficiency, their revenues, and their profits.

I'm going to take a commercial perspective to the topic at hand. We like to talk about commercial AI and what we do. What that means is we work across several industries: retail, consumer goods, manufacturing, however we don't really work in the government sector. Obviously, there's a huge commercial element to the finance sector, but we're not involved in that. It's mostly these other traditional sectors that haven't really adopted AI, at the same pace as other industries have.

I have a PhD in non-equilibrium molecular dynamics, and I was involved in some of the early work applying Machine Learning to atomic systems. The reason I'm at Peak is because commercial AI is really exciting. AI in general is moving really fast, and I personally found academia to be moving relatively slow. Therefore, moving to a business where you can get hold of real data and solve real problems is really exciting for data scientists. That's why a lot of people at Peak come from academia, because having that impact is something that's important to them.

Why is Commercial AI Important?

We believe commercial AI is really important for a couple of reasons. Every business is different. Every business has different data, different skills, different products, different customers, different goals, different challenges. AI all can account for, or adapt to, a lot of

these differences.

I'll just take a step back. The more information you have, the better you can plan and the more informed decisions that you can make. Data is just an expression of information. When you interpret data, that's how you get information. The words on a page can be thought of as data, and what the meaning of the sentence is, can be is information. As society has developed, the amount of data that we have has grown. We've had business for millennia. All that information was in people's heads and on documents, then in filing cabinets, and on spreadsheets. So, businesses have always succeeded with more information.

With the third industrial Revolution[23], the ability to store and process more information in the form of data has grown, and this has helped society immensely. Modern supply chains are exceptionally large, and very complex, they span continents. They only exist because we have modern data driven ways to manage them. However, we're at a point where we need to use tools to help extract that information. It can't all live in people's heads or just on documents anymore.

AI can spot patterns that we can't spot on an even larger scale. It can automate processes, it can generate predictions, it can even identify biases in our own decisions. That's something I just like to do for fun when I make decisions at peak. I'll code it up and see if it predicts the same thing, and if not, why not? Am I biased?

We make decisions still as people, but AI can be used to support us. This will help result in economic superiority, particularly in the commercial sector where increasing revenues, profits and efficiency are common business objectives.

How does it work in practice? Anywhere you have data, and anything you can model with data you can apply AI to. A lot of what we call out is very simple automation or statistics. You can go through processes, find keywords, and then automate that. It doesn't necessarily need to be fancy **ChatGPT** type models. Everything that falls under AI today is very broad.

Examples of where Peak is applying AI

We do consumer related AI, we do recommendation systems, we do customer segmentation, but helping businesses with their problems with data and helping them be more competitive, most of it's not actually in that space, even for retailers.

If I take merchandising as an example. Retailers have merchandising teams, and merchandising team has a lot of responsibilities. One of their jobs is to reorder more products so they don't run out of stock, and miss sales – also, that they don't hold too much stock. A business that has 1000 items, if they've got 100 locations in the UK, if they have to order

[23] The Third Industrial Revolution is a transformative era characterised by the digitalisation of industries and the widespread use of internet technology, resulting in increased connectivity and sustainable practices.

monthly, let's round that down to 10: 100 x 1,000 x 10, equals 1 million decisions to make a year. That's not even a large business. A merchandising team to do that job right has to make a million decisions a year.

To make each decision well they need to understand the current stock levels of each product, they have to understand the recent sales, they have to understand seasonal sales trends, to understand strategic positioning in the market. Merchandisers have to take all of this information, pull it together and predict what they think is going to happen and order more stock based on that. What they often do is they focus on the top sellers and the bottom sellers, and they leave the middle 80% out. That's inefficient - it creates overstocking and waste, particularly on perishable items. It creates poor availability on other products, which means missed sales and missed opportunities – this is a prime example for commercial AI.

We use commercial AI across many other businesses in similar ways to help or optimise supply chains. Some of our customers include Nike and PepsiCo. There are some fairly large businesses that benefit from this.

Concluding Remarks

To wrap up, Peak's position is they own the commercial space has numerous benefits: from risk management to reduction of CO_2, to less waste. Where we're optimising vehicle routing, we're seeing a great reduction in CO_2.

AI should be seen as an opportunity to create more stable, sustainable businesses that drive prosperity and not seen as a threat.

We think the creation of the **Department of Science, Innovation and Technology**[24] is welcome. It is a pivotal step for UK-tech on our journey to becoming an AI power.

Our primary goal at Peak is to continue the conversation with regards to regulation of AI, which the UK Government laid out last year. We as a business champion a context-specific approach and envisage that splitting this by existing and new use cases within regulated and unregulated industries would result in a lighter touch approach for commercial AI, which will increase innovation and applicability to UK businesses.

[24] **Department of Science, Innovation & Technology.**
https://www.gov.uk/government/organisations/department-for-science-innovation-and-technology

Prof. Vili Lehdonvirta, Professor of Digital Social Research, Oxford Internet Institute

Introductory Remarks

My name is Vili Lehdonvirta, I'm a professor at the **Oxford Internet Institute**, where I lead a research group on the digital economy.

Last year I published a book titled **"Cloud Empires"**[25], which draws conclusions from our past six years of research. In particular, I discuss the ways in which large technology companies are complementing but also challenging and, in some cases, overtaking state power and sovereignty. Now AI technologies, obviously have many important applications ranging from industry and civil service to military and intelligence, and as such they can strengthen a country's economy and improve its state capacity.

Implications of Frontier AI Technologies Infrastructure

However, what I would like to draw your attention to today is the geopolitical implications of the considerable material infrastructures required to develop and operate frontier AI technologies. For instance, the amount of computing power or compute required to train **ChatGPT** is such that it would take a single GPU such as you find in your ordinary high-end

[25] Prof. Vili Lehdonvirta – **'Cloud Empires: How Digital Platforms Are Overtaking the State and How We Can Regain Control'** (September 2022). https://mitpress.mit.edu/9780262047227/cloud-empires/

computer about 288 years to finish a single training run.

So, to make any sort of progress, frontier AI developers use many GPUs in parallel. **OpenAI**[26] is said to have used 10,000 GPUs to develop **ChatGPT**, reducing the training time from centuries to days.

Now where do you find thousands of GPUs set up for AI research? Possibly just two or three places in the UK. These are in hyperscale data centres owned by Amazon, Google, and Microsoft. This means that to do any serious research on large AI models, you have to send your data to one of these so-called hyperscalers, and either pay them or partner up with them.

Once you've trained your model, to actually deploy it into use so that it can be used by many people simultaneously, you may need even more compute, which again is only really available from hyperscale cloud providers. As a result, pretty much all independent AI research labs, even ones explicitly established as an alternative to the hyperscalers, have eventually fallen right into the lap of these three major firms: OpenAI to Microsoft, DeepMind and Anthropic to Google, Hugging Face to Amazon, and so on.

So, there is a concern that the more we lean into AI as a society, the more dependent we become for both R&D and for daily operations on infrastructures owned by a handful of hyperscale corporations domiciled abroad. It also means that on a geopolitical level, UK may lack the autonomy to steer the development of frontier AI in a manner aligned with UK's values and objectives.

Interventions by Governments

Many academic AI researchers deem this situation unacceptable and are calling for intervention from the Government. Professor Michael Woolridge of the Alan Turing Institute and Oxford University is calling for a sovereign high-performance cloud infrastructure. Just last week the UK Government's Independent Review of The Future of Compute[27] published an excellent final report, which calls for the government to immediately establish a UK AI Research Resource, which would be incorporating at least 3,000 top-spec GPUs.

However, other governments have tried something like this before, and the results have not been entirely encouraging:

- France launched its first sovereign cloud project already in 2009. But it never won much adoption and in 2020 it was shut down as a failure.
- In 2021 the French government announced a new “trusted cloud” initiative, delivered

[26] **OpenAI.** https://openai.com/
[27] Department for Science, Innovation & Technology – **‘Independent Review of The Future of Compute: Final report and recommendations’** (March, 2023). https://www.gov.uk/government/publications/future-of-compute-review/the-future-of-compute-report-of-the-review-of-independent-panel-of-experts

by Thales and Orange Telecom -- but in partnership with Google and Microsoft.[28]
- Germany's new "sovereign cloud" is likewise delivered by local firms in partnership with Google and Microsoft.[29]

Nominally these national clouds are controlled by the local firms, but in practice they remain part of the technological supply chains of the U.S. hyperscalers.

I think it's very important to ask why efforts to build and sustain sovereign cloud infrastructure have proven so difficult. My working hypothesis is the following. Like any infrastructure, cloud infrastructure requires sufficient scale to be viable. But for cloud computing, this efficient scale is extraordinarily high.

One Amazon data centre contains tens of thousands of servers, and the total number of servers that make up Amazon's global computing platform are measured in the millions. This means that costs such as cybersecurity, administration, and R&D are divided between millions of clients, enabling Amazon to develop and sustain a great variety of advanced services on top of the basic computing hardware, which are important for AI research.

A UK Sovereign Cloud

So unfortunately, I'm compelled to ask, if we build a sovereign cloud in the UK, can we sustain the scale of investment required to keep it up to date? Or even to reach this state of the art in the first place? Google alone invests about twice as much money each year into R&D than the entire UK public sector.

It is conceivable that hyperscale cloud computing is a type of infrastructure in which the efficient scale is higher than what any medium-sized state alone can sustain. If this is the case, then two different geopolitical paths may be possible:

1. The UK collaborates with other countries, such as France and Germany, to reach the critical mass required to sustain cutting-edge cloud in public ownership.
2. The UK simply doubles down on using the U.S. hyperscalers, and attempt to manage the dependence on a political level. After all, the UK is already dependent on the U.S. in various other ways. Even GCHQ and MI5 reportedly store their secrets on Amazon's platform.[30]

But to ascertain whether these are really the paths available, or whether a sovereign UK-only infrastructure is after all possible, my recommendation would be to urgently pursue more

[28] **'Thales and Google form French sovereign cloud service joint venture'** (October, 2021). https://www.datacenterdynamics.com/en/news/thales-and-google-form-new-joint-venture-for-french-sovereign-cloud-service/
[29] **'Germany's 'sovereign cloud' is coming—and it's provided by Google'** (September, 2021). https://fortune.com/2021/09/08/germany-sovereign-cloud-google-t-systems/
[30] **'Amazon strikes deal with UK spy agencies to host top-secret material'** (October, 2021). https://www.ft.com/content/74782def-1046-4ea5-b796-0802cfb90260

research on the economics and geopolitics of AI.

5. Speaker Bios

Gita Shivarattan, Head of Data Protection Law Services, EY-UK

Gita is the Head of Data Protection at EY Law, based in London and focuses on data protection compliance, leveraging data as an asset, and digital transformation through data.

Gita is a UK-qualified solicitor and experienced in UK data protection law and attendant legal issues around data exploitation, digital transformation, and regulatory compliance. She has extensive knowledge of a range of technology, commercial and data protection law matters, and regularly advises clients on IT outsourcing and data protection.

Gita was recognised by Law.com as a top 25 UK female rising star in 2022 and listed as a rising star in privacy and data protection by Expert Guides 2020 and 2021. She is a member of the Financial Markets Law committee, the Data Protection Finance Group and is CIPP/E certified.

Tom Nixon, Director of Government Practice, Faculty

Before joining Faculty, Tom was a Senior Civil Servant with wide experience across Government policy and economist roles. At Faculty, Tom has led data science and AI programmes with the National Crime Agency, the Home Office, DCMS, BEIS, the Maritime Coastguard Agency, Cabinet Office, the ASA and GDS, among several others.

He has 10 years' experience in Government, including as Head of Strategy at the Department for Education and Senior Adviser on Economics Affairs and Technology to Prime Minister David Cameron. He holds a first-class degree in Economics from the University of Cambridge and a postgraduate diploma in Economics from Birkbeck, University of London.

Stuart Davie, Vice President – Data Science, Peak

Stuart Davie is VP Data Science at AI company, Peak. Joining the company in 2016 as one of the first employees, Stuart has built a large team of data scientists across three regions.

Stuart holds a PhD in non-equilibrium molecular dynamics and has been instrumental in developing Peak's AI applications that help businesses achieve a competitive advantage. An honorary Mancuncian, Stuart now resides in Brisbane, Australia, with his family.

Vedran Podobnik, Director – Global Lead for Data, Analytics & AI, Hewlett Packard Enterprises

Vedran leads a team of data professionals and engineers solving complex business problems with data, analytics and AI. With over 15 years of international experience as a technology leader, consultant and university professor, Vedran brings a creative, pragmatic and data-driven approach to driving sustainable change. His talents are specifically focused on AI/ML, advanced data analytics in hybrid cloud environments, digital transformation of enterprises and agile product and service management.

He has executed multi-year IT development and innovation projects and delivered large scale international programmes. He has worked in private and public organisations and in a range of sectors with the most recent experience in retail, technology, automotive and banking. He also has an extensive track record in people management and is passionate about mentoring and developing people and leading teams.

He is a founder and director of "SocialLAB", an organisation that gathers academics and businesses interested in developing innovative data-driven products and services based on AI/ ML. He sits on the management board of the Center for Artificial Intelligence in Croatia.

Prof. Vili Lehdonvirta, Professor of Digital Social Research, Oxford Internet Institute

Vili Lehdonvirta is Professor of Economic Sociology and Digital Social Research at the Oxford Internet Institute, University of Oxford. He is a Senior Research Fellow of Jesus College, Oxford, and a former Fellow of the Alan Turing Institute in London. He has served

on the European Commission's Expert Group on the Online Platform Economy and the High-Level Expert Group on Digital Transformation and EU Labour Markets.

For the past seven years Vili has led a research group in Oxford examining how digital technologies reshape economies and with what implications to workers, entrepreneurs, and policy makers. Lehdonvirta's research has been supported by the European Research Council, the UK Economic and Social Research Council, and other science funding agencies.

Vili's previous book Virtual Economies: Design and Analysis was published by MIT Press in 2014 and translated to Chinese and Japanese. Before gaining a position in Oxford he worked at the Helsinki Institute for Information Technology, the University of Tokyo, and the London School of Economics and Political Science. Vili was born in Finland and worked as a software developer before embarking on a career in social science.

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