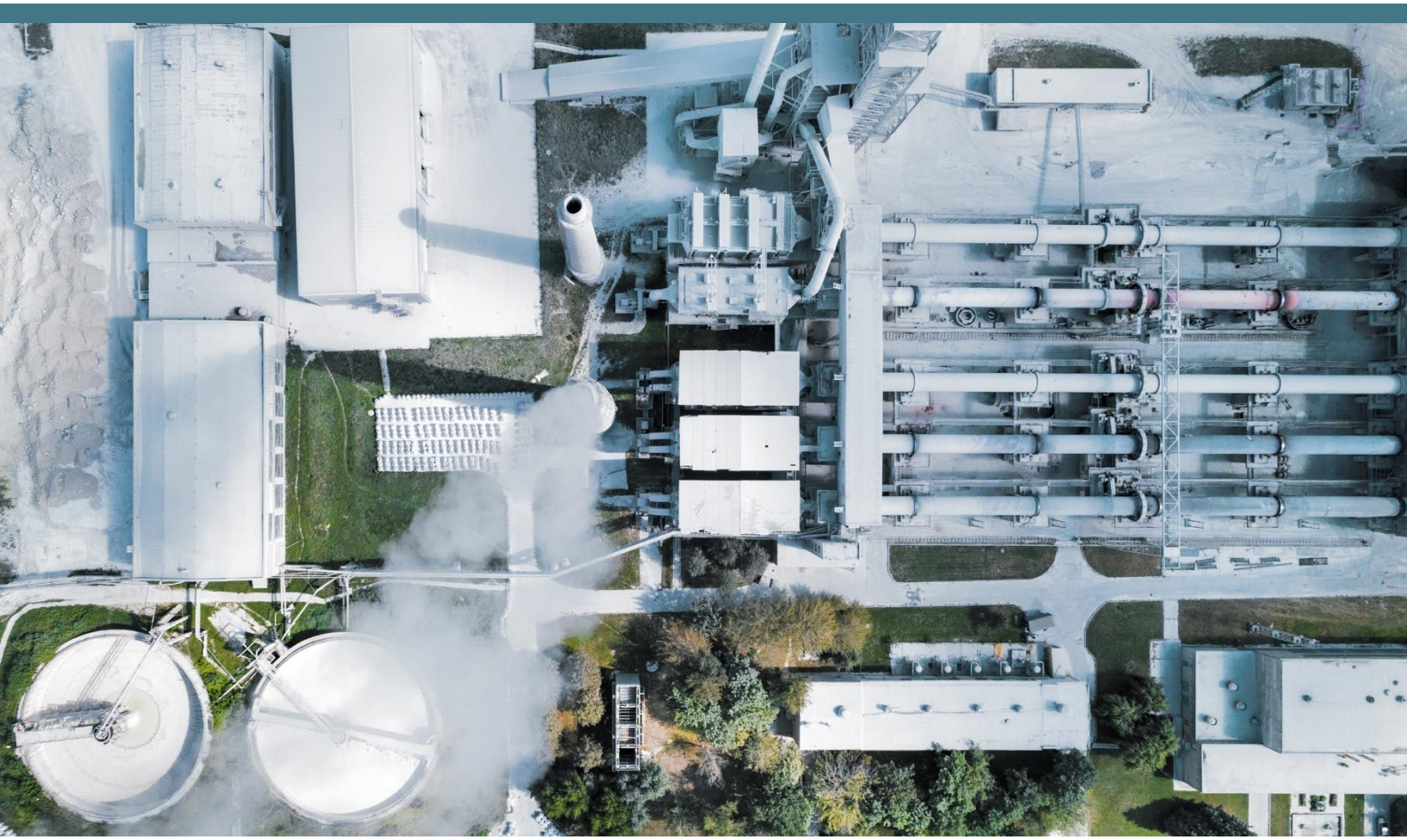
SPATIAL FINANCE INITIATIVE

Asset-Level Data Annual Meeting Event Report

8 June 2020

Hosted by:
GeoAsset Project, Sustainable Finance Programme, University of Oxford
2° Investing Initiative



Overview

The *GeoAsset Project* at the University of Oxford, as part of the Spatial Finance Initiative, partnered with 2° Investing Initiative to host a meeting on asset-level data on 8th June 2020. GeoAsset, successor to the Asset-level Data Initiative (ADI), has three primary goals: to improve the quality of asset-level data across all key sectors; to increase availability through the creation and maintenance of trusted, publicly-available datasets; and to generate demand for asset-level data and associated services.

Financial decision-makers face an unprecedented combination of social and environmental risks, and associated opportunities, relating to climate change in particular. Understanding these risks at the required level of granularity increasingly means assessing them at the asset level. As its use in investment decision-making evolves, asset-level data is increasingly found alongside satellite imagery and remote sensing data, as well as advanced artificial intelligence analytics.

The meeting took stock of where we are today with respect to the availability and use of asset-level data and how it can contribute to better decision-making. It explored avenues for collaboration on driving asset-level data into the mainstream of risk and opportunity assessment. Most of all, the meeting provided a forum for discussion, debate, and learning for actors across the finance, research, and policy spectrum, ranging from investment professionals, to data scientists, to government departments.

Note on report format

As a result of the ongoing impact of COVID-19 on travel, this event took place virtually. Under normal circumstances, the meeting would have taken place under Chatham House rules to encourage a candid and engaging discussion. In a similar spirit, this report is written in Chatham House format (except for the showcase presentations).

Acknowledgements

This report was prepared by Alex Clark (Smith School of Enterprise and the Environment at the University of Oxford), with support from Catherine McNally and the analyst team at 2° Investing Initiative.

Introduction

The meeting opened with a challenge: achieving the goals of the Paris Agreement requires us to understand the impacts of current and future planned assets on the environment, as well as the associated stranded asset risks. To do this bottom-up analysis, users need universal, accurate, comparable asset-level datasets, including information on asset characteristics and ownership on a sector-by-sector basis. Recent developments in data capture and processing allow us to do this at a speed and scale not previously possible.

It was suggested that voluntary disclosure is not enough, with little prospect of enabling the company-level analysis of assets and portfolios needed for alignment with Paris. Asset-level data provides the granular, traceable information required for astute judgement on climate risk that aggregated corporate reporting does not provide. Corporate disclosure alone provides little insight into the links between balance sheets and the assets populating them.

The challenge does not end at mapping the assets themselves: identifying the contracts governing the ownership of assets is just as important. Even with both pieces in place, difficulties remain in identifying where risk lies at the system level, where environmental footprints are generated, and how these insights can be quickly and accurately matched with existing data systems.

Coordination was identified as a key stumbling block without which accurate, publicly available asset-level data will not become available in a timely fashion. A public goods, open source approach to asset-level dataset development was proposed. Parallels were drawn to the Human Genome Project of the 1990s and early 2000s. We are now in a position to sequence and decode the DNA of the real and financial economies in a more detailed and responsive way than previously possible, there being no reason why a series of datasets for the global economy could not be produced, starting with the most polluting, high-carbon sectors.

There was acknowledgement that difficulties remain. The importance of designing and implementing the right software solutions was underlined, as were the remaining challenges of gathering micro-level data for application to agricultural and intangible assets; as well as the need to map the mobility of assets where applicable, e.g. in the transport sector.

The next 12-18 months, building up to COP26 in Glasgow, were identified as an important time to seek buy-in from governments and other key stakeholders to accelerate the development and use of asset-level data for the public good.

Showcase Presentations

Three brief showcase presentations were given by organizations actively using asset-level data for a range of use cases linked to climate change.

Carbon Tracker Initiative (CTI) presented work using asset-level data and satellite imagery to estimate the utilization rates (hence also operating cashflows) of coal plants. Doing this can shed light on the economic and financial viability of coal assets in a way could not be done previously. This type of analysis is relevant to investors interested in using utilization rates to estimate economic metrics. Applying these geospatial-enhanced methods, CTI finds 40% of the operating coal fleet is running at a loss. Along with rising long-run marginal costs, this implies that by 2030, most coal plants will cost more to run than building new renewable facilities. There is scope to expand this methodology to heavy industry, particularly steel, cement, and petrochemicals.

MSCI stressed the usefulness and importance of accurate location data in the context of physical climate risks. Gathering information on the location and exposure of specific assets can help us understand and ultimately predict the impacts of physical events. The priority currently is collecting more data on the ownership and site characteristics of assets across all major sectors, to enable greater accuracy in risk assessments, and to enhance the ability to aggregate to the company level. MSCI use a 'mosaic' approach, relying on multiple conventional data sources, alternative data sources, and manual collection. Alternative sources include satellite data, although challenges remain in categorising assets this way without requiring significant manual labour. One of the primary use cases to date is the calculation of value at risk (VaR) to physical climate impacts. The expected cost of these impacts for a given asset is the product of exposure, hazards, and vulnerability. Applying this to Tohoku power plants in Japan shows that some are already at risk. In communicating the value of the approach to investors, transparency of methodology and openness to its limitations are priorities.

The Cross-Dependency Initiative (XDI) showcased its physical climate risk engine. The system, focused on hazard exposure (with different vulnerability algorithms for different hazards), is a queryable database designed to analyse physical risks for individual assets at specific locations. The risk engine has been used for mortgage assessments, in collaboration with banks and insurers. However, the approach was originally developed for utility firms, not the finance sector, and challenges remain in using it to drive change in both commercial and public finance more broadly. In post-event analysis of the 2019 Australian bushfires, it identified new areas of vulnerability that were not previously considered as such, with implications for lenders and insurers, as well as resource planning for emergency services.

XDI is now aiming to assess asset exposure at the company level, including cross-dependences across assets and estimating the indirect consequences of losing access to critical supply lines and logistical infrastructure, which can be more significant at the company level than direct hits to fixed assets. Also being explored is the use of asset-level data to monitor reporting to the Task Force on Climate-Related Financial Disclosures (TCFD) framework and to develop the ability to hold misleading or weak reporting to account.

Several themes were brought out in the discussions that followed. Participants asked about the use of natural language processing (NLP) to sort and match company names, reducing the need for ongoing manual labour to keep asset ownership information current. Tracking and reflecting corporate events like mergers, name changes, and restructuring was identified as a particular challenge. The importance of assessing supply chain impacts was reemphasised, particularly for intangible assets or those without a fixed physical location.

Also discussed was the wide variation in data quality and availability, with some data relatively accessible through open platforms, and other data not accessible in this format, notably telecommunications data. Finally, participants agreed that the challenge of determining the ownership structure around individual assets remains a key stumbling block in moving from bilateral engagements with client companies, to working in a more adversarial way with target companies with exposure to climate risks. While direct mapping of asset ownership using financial databases and annual reports is one solution, using multiple data sources to identify asset usage, as a proxy for ownership, is one potential way of getting around this problem.

Curating, using, and publishing asset-level data

The first panel discussion of the day focused on several definitional and structural issues around asset level data.

The discussion began by asking what is meant by asset-level data, and how it relates to spatial finance. Participants suggested that definitions of asset-level data tend to vary, not least because few in the industry know how to gather it. Being able to identify assets from space is different from identifying who owns it, how much it cost to build, etc. Rapid advances in AI and cloud computing are helping to bring these datapoints together, with those at the forefront focused on turning asset-level data with spatial characteristics (or the reverse) into financial metrics and operational insights.

In impact bond markets, asset-level data can help fund managers identify the types of assets being financed, particularly since these are mainly 'hard' physical assets. This is important for monitoring performance for the use of proceeds. Asset-level data for risk analysis is similarly important, even for bonds financing 'green' projects – since greenness does not imply immunity to physical climate risks. Physical climate risk is also gaining prominence in equity markets, with some analysts identifying rapidly increasing risks that are still unpriced. Across these markets, granular spatial data can be key in identifying the risks associated with specific assets and estimating the implications for the issuer. Participants generally agreed that spatial data will become a core tool for financial analysis, particularly as modelling and estimation techniques improve to the point that they can replicate historical data accurately.

Disclosure has been helpful in making some progress but is not enough to develop tools that are data-rich, comprehensive, and applicable to investment decisions. Data gathering at the company level remains largely confined to bilateral engagement. Traditional approaches to modelling climate risks are still top-down and low-resolution, with the most actionable insights still coming from direct (and costly) engagement with individual companies. Even then, results from direct engagement vary widely, with some companies not having thought about climate risk exposure at all, let alone developing strategies to adapt to them.

It was suggested that there is a need to focus on the difficult, data-scarce cases, rather than 'preaching to the choir' by continuing to engage with companies that perform relatively well on TCFD metrics. With 11 disclosure areas, and most companies publishing data on only some of them and not in a consistent way, overall TCFD compliance is not yet providing decision-useful information at a granular level. Asset-level data provides opportunities not only for standardising disclosure and risk assessment, but for modelling and understanding the impact of a range of possible scenarios across companies and sectors.

The discussion then turned to the challenges in developing trusted insights from asset-level data in the context of climate change. There are at least three areas where progress is needed: (i) improving the flow of asset-level information to support decision-making; (ii) enhancing the ability of financial services firms to measure and disclose risks – which in turn depends on access to underlying data; (iii) ensuring the availability of capital to finance the transition to net zero emissions.

Participants also focused on what a viable business model for asset-level data might look like. Consistent with the opening remarks, the consensus was that addressing the scarcity of asset-

level datasets was a key stumbling block to quantifying risk and opportunity. However, they also posited that, once foundational datasets are available, the added value of asset-level data lies primarily in processing and packaging the data in a form relevant to the financial industry. There was recognition that methodologies need to be flexible and iterative to accommodate these needs; and a need to be transparent about the quality of underlying data, which is a major concern for financial firms buying off-the-shelf spatial data products.

The session concluded by identifying upcoming challenges and opportunities for asset-level data and spatial finance. These included:

- explicitly and convincingly mapping spatial information to TCFD recommendations;
- using spatial finance to identify and solve for systemic risks and cross-dependencies within and between companies;
- clearly articulating the contributions of satellite imagery, AI, and remote sensing to the responsible management of natural and physical capital in private and public sectors alike.

Sector-specific challenges and solutions

The first set of breakout sessions focused on the challenges and opportunities for gathering and using asset-level data in key sectors considered to be at the frontier of data collection efforts. This includes outlining the quality and granularity requirements for using asset-level data in these sectors in financial decision-making.

Session 1A: Heavy industry, transport, linear assets, and infrastructure

In this session, participants discussed approaches to creating and using asset-level data across several key industrial and commercial sectors.

Cement and steel production is the dominant component of heavy industry globally by emissions. Existing datasets cover 70-75% of emissions, with many of the gaps found in China, the world's largest producer in both industries. The Spatial Finance Initiative is leading an effort to create an improved, comprehensive dataset including ownership information for over 90% of global plants, using geospatial data, enhanced by machine learning techniques, to identify plants and their characteristics. Manual web scraping is used to complete and verify the results. Experience so far suggests that cement facilities are relatively homogenous, hence easier to classify, relative to iron and steel plants.

Work is also under way to assess physical climate risk in the transport sector. The dominant challenge for transport is the mobility and sheer number of individual vehicles. To negotiate this problem, analysts are focusing on fixed infrastructure as a proxy, looking at train lines, airports, and bridges, overlaying these with climate risk datasets. These and other linear assets (pipelines, roads, etc.) can provide meaningful insights on where critical points of failure are likely to arise, and the network effects these are likely to produce. Issues with asset-level data in transport and linear assets are similar to those in other sectors: traceability of risk is limited by difficulties in merging databases and establishing ownership systematically, e.g. linking assets to specific bonds and issuers.

Linear assets are also being assessed from a conservation standpoint in identifying the intersection of China's Belt and Road Initiative projects with protected areas, and engaging with the owners of those assets. While important insights have been drawn from this process, licensing constraints often prevent publication of the data and making it available to financial institutions more widely.

It was highlighted that the applications of asset-level data are not limited to the private sector, with a range of potential applications in the public sector ranging from planning and emergency response, to state-owned asset managers and green investment banks. Participants also expressed concern over the continued dominance of research institutes and NGOs, and relative lack of commercial interest, in developing asset-level applications in these sectors, despite the clear need for better data and monitoring of climate, conservation and biodiversity risks and evidence that these risks are material to financial institutions.

Session 1B: Agriculture and forestry

The session on agriculture and forestry touched on several key themes.

First, while the use of satellite data for monitoring purposes has seen some success (e.g. to track the use of proceeds of bank loans, to assess credit risk, and to identify insurance fraud), the overriding challenge in using satellite data to track agricultural assets is in establishing who owns the land, and how the risks they are exposed to affect global supply chains. Investors are looking for ways to track hazards like fires and floods in near-real-time and then link those events to individual financial securities. Since machine-readable property data remains scarce, it is difficult to identify the boundaries of plots of land without conducting extensive due diligence. High-resolution data is critical for these sectors, since physical climate impacts can vary significantly at the local level, as well as by crop or tree type.

Participants also agreed that the most effective way of curating and presenting useful asset-level data in agriculture and forestry depends largely on what the 'assets' are and what the dataset is for. The focus may be on the land itself (which in many geographies is dominated by smallholders), or on the products making up the portfolios of buyers. There are growing opportunities in the latter space, using a combination of techniques including automated web scraping and environmental footprint analysis. Similarly, different data points and processing techniques are needed for assessing risks to inform an investment decision, versus monitoring them in order to manage risk.

There is also a need to define more clearly what sorts of decisions might be implied by an asset-level dataset for agriculture and forestry. It was also suggested that the potential materiality of agricultural asset-level data to decision-making process depended significantly on the target audience. Large investors in agriculture and forestry, for example, need spatial data to be available at the fund level for it to be material to investment decision-making. At the same time, aggregated data has limitations, and advanced techniques are needed to combine granular indicators and understand the relationships between them and outcomes on an asset-by-asset basis. This generates a considerable amount of uncertainty over how asset-level data can be made useful and what companies, financial institutions and governments should do with it.

Finally, participants pointed out that food is a staple product for which 'good' and 'bad' cannot be easily disentangled, unlike e.g. power generation, heavy industry or even forestry, where decarbonisation is the primary imperative.

Methodologies and applications

The second set of parallel sessions outlines progress in measuring and understanding risk from asset-level data, and the application of advanced data analysis techniques, including but not limited to AI/machine learning algorithms and satellite imagery.

Session 2A: Machine learning, AI and asset-level data

Advances in machine learning and artificial intelligence are highly relevant to the fields of asset-level data and spatial finance. In this session, participants discussed current and future developments in integrating these techniques into models and methods for producing and using asset-level data. There was overall agreement that there are many opportunities for AI in this field, and that developing these applications can increase interest in, and assessment of, genuinely sustainable investments.

A key area in which AI is being applied is in monitoring the exposure of physical assets to environmental change, particularly in sustainable debt markets. A combination of machine learning and remote sensing was applied to US water utilities to assess environmental risks to their credit ratings, finding that the greatest predictors (evergreen forests, natural reservoirs, and snowfall) were also those most vulnerable to climate change.

Participants also returned to the earlier theme that voluntary disclosure, even under an AI-enabled lens, is insufficient – and that satellite data and remote sensing technologies are capable of significantly increasing investors' ability to track the compliance of specific assets with emissions standards, and to match observed emissions to these assets. Information in a variety of forms (e.g. street-level images, audio) has already been used successfully to measure and predict pollution from specific sources. Satellite imagery is a useful addition, but with the right processing tools, data collected in real time with no specialist equipment is capable of mirroring, with greater frequency and flexibility, many of the monitoring functions satellite data currently performs.

The emergence of natural capital accounting and growth of the Internet of Things also presents opportunities for integrating natural capital in a range of forms to financial information via remote sensing and advanced 'deep learning' analytics. It was suggested that the ability to process vast quantities of information and identify unexpected or obscure patterns can help link upstream information to portfolio management (e.g. linking pests and fertiliser use to financial ratios). The major limitation on current efforts to do this is a lack of reliable training data.

The session concluded that big challenges remain in exploiting the full potential of AI in asset-level data and spatial finance. Some of the high-impact applications put forward as priorities included tying physical assets to portfolios and climate change scenarios in a granular way; enhancing the comparability of existing data sources; ensuring consistency in TCFD reporting; improving the auditability of disclosed information; and using deep learning to define parameters of transparent statistical models that can be analysed and interpreted as a means of getting around the 'black box' problem common to many existing products. A key condition to rapid progress identified by participants was the establishment of much more extensive dialogue between the AI, data science, and finance communities. Greater communication can help to anticipate and deal with the well-known problems of aggregation and trust in AI-driven models.

Session 2B: Measuring and understanding risk

In this session, participants looked at the status quo, best practices, and gaps in using asset-level data to analyse (primarily climate and environmental) risk.

The first half of the discussion focused on the nuances that are often not made explicit when dealing with asset-level data. Data providers typically do not have complete datasets for a given sector, nor are the data they do have necessarily consistent. For large physical assets, for example, information is easier to obtain in regulated industries (since the government often collects, maintains, and publishes it) than in unregulated ones, with similar asymmetries applying to publicly traded versus private companies.

Participants also agreed on the importance of clear definitions when discussing risk, particularly when related to physical events. Once assets are located, it is important to distinguish clearly between exposure (primarily a function of the location) and vulnerability (which requires overlaying location data with the features of a specific asset). To be meaningful, assessing risk at the asset level requires integrating both, which in turn requires the integration of foundational datasets describing individual assets with observational datasets describing physical impacts by location.

As highlighted in other sessions, increasing asset-level data availability also has the potential to create risks for companies, and potentially for financial institutions subject to fiduciary regulations. The application of asset-level and spatial data to pursue and litigate legal claims against individual companies were discussed, including a case brought by Client Earth against a Polish coal company. There are also potential impacts on borrowing costs for countries regularly issuing debt on sovereign bond markets, particularly if asset-level or remotely sensed information signals that regulations are not being successfully enforced, that natural capital is being eroded more quickly than expected, or that critical infrastructure linked to GDP growth is vulnerable to climate risk.

The discussion then turned to the users, and the market for risk analysis products based on asset-level data. It was suggested that with current technologies and data availability, granularity often comes with trade-offs, typically generating a greater amount of noise, the more detailed the assessment. Responding to a point raised in an earlier session, participants highlighted these and other limitations (mostly linked to a lack of data supply and a lack of coordination in procuring it) to explain why research institutes and non-profit organisations continue to lead in this space, when the market should have a bottom-line incentive to build these capabilities.

Summary

It was clear from the day's discussions that there is an urgent need for foundational asset-level data tied to ownership across multiple sectors, to help unlock the full potential of spatial finance and remote sensing technologies for risk assessment and management. Themes included the need for investors, governments, and other actors to coordinate closely in the creation of a functioning market for asset-level data products; and the added value of tailoring data processing and analysis to specific users, particularly in the financial sector.

To become decision-relevant for market actors and policymakers, asset-level data and relevant observational data layers need to be harnessed and presented in a scalable, interpretable way tailored to the needs of market actors and policymakers alike. The increasing maturity and sophistication of granular spatial analysis is a promising development, but must remain focused on the user to have a real impact. Asset-level data can deliver the quantitative robustness and narrative links that private and public actors need in order to manage their assets consistent with planetary boundaries.

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Partners of the Spatial Finance Initiative

Oxford Sustainable Finance Programme

The Oxford Sustainable Finance Programme at the University of Oxford Smith School of Enterprise and the Environment is a multidisciplinary research centre working to be the world's best place for research and teaching on sustainable finance and investment. We were established in 2012 to align the theory and practice of finance and investment with global environmental sustainability.

We research environment-related risks, impacts, and opportunities across different sectors, geographies, and asset classes; how such factors are emerging and how they positively or negatively affect asset values; how they might be interrelated or correlated; their materiality (in terms of scale, impact, timing, and likelihood); who will be affected; and what affected groups can do to pre-emptively manage risk. Since our inception we have conducted pioneering research on stranded assets and continue to undertake significant research on the topic.

The production of high-quality research on the materiality of environment-related factors is a necessary, though insufficient, condition for these factors to be successfully integrated into decision-making. Consequently, we develop the data, analytics, frameworks, and models required to enable the integration of this information.

We are pioneers and advocates of 'spatial finance', a term we have coined that refers to efforts to bring geo-spatial capabilities into financial analysis. As such we are developing new asset-level datasets through data science and combining these with new approaches to spatial analysis, scenarios, and stress tests.

We also research barriers to the adoption of practices related to sustainable finance and investment. This includes the role of governance, norms, behaviour, and cognition, as well as policy and financial regulation in shaping investment decisions and capital allocation.

The Oxford Sustainable Finance Programme is based in a world leading university with a global reach and reputation. We work with leading practitioners from across the investment chain (including actuaries, asset owners, asset managers, accountants, banks, data providers, investment consultants, lawyers, ratings agencies, stock exchanges), with firms and their management, and with experts from a wide range of related subject areas (including finance, economics, management, geography, data science, anthropology, climate science, law, area studies, psychology) within the University of Oxford and beyond.

The Alan Turing Institute

The Alan Turing Institute, headquartered in the British Library, London, was created as the national institute for data science in 2015. In 2017, as a result of a government recommendation, we added artificial intelligence to our remit.

Our mission is to make great leaps in data science and artificial intelligence research in order to change the world for the better. Research excellence is the foundation of the Institute: the sharpest minds from the data science community investigating the hardest questions. We work with integrity and dedication.

Our researchers collaborate across disciplines to generate impact, both through theoretical development and application to real-world problems. We are fuelled by the desire to innovate and add value.

Green Finance Institute

Established in 2019, the Green Finance Institute (GFI) is an independent, commercially focused organisation, supported by HM Treasury, the Department for Business, Energy and Industrial Strategy and the City of London Corporation.

As the UK's principal forum for public and private sector collaboration in green finance, we are uniquely placed to accelerate the domestic and global transition to a zero-carbon and climate-resilient economy through the mobilisation of capital.

We convene and lead mission-led coalitions, made up of networks of dynamic decision makers, to identify and unlock barriers to deploy capital at pace and scale towards impactful, real-economy outcomes.

Satellite Applications Catapult

The Satellite Applications Catapult is an independent innovation and technology company, created by Innovate UK to drive economic growth through the exploitation of space. We work with businesses of all sizes to realise their potential from space infrastructure and its applications.

Based in Harwell, Oxfordshire, the Catapult was established in May 2013 as one of a network of centres to accelerate the take-up of emerging technologies and drive economic impact for the UK. We are a not-for-profit research organisation which is registered as a private company limited by guarantee and controlled by its Board.

The world is in the early stages of a new digital revolution, with space technology increasingly at its heart. Satellites are critical infrastructure, as fundamental to the global economy as the energy grid or internet, and space is a UK success story. In 2016, the industry was worth £13.7bn, and working with the wider UK space community and the UK Space Agency we will help grow this to £40bn by 2030.

2° Investing Initiative

The 2° Investing Initiative (2DII) is an international, non-profit think tank working to align financial markets and regulations with the Paris Agreement goals.

Working globally with offices in Paris, New York, Berlin, and London, we coordinate the world's largest research projects on climate metrics in financial markets. In order to ensure our independence and the intellectual integrity of our work, we have a multi-stakeholder governance and funding structure, with representatives from a diverse array of financial institutions, regulators, policymakers, universities, and NGOs.