ORDNANCE SURVEY

SBRI Feasibility Study

Final Report

UK Space Agency - SBRI FEASIBILITY STUDY

GEOSPATIAL UNLOCKING EO (EARTH OBSERVATION) FOR USE IN FINANCIAL SERVICES TO SUPPORT IMPROVED OUTCOMES FOR INVESTORS, ENVIRONMENT AND SOCIETY

This report is work commissioned by the UK Space Agency through Contracts for Innovation. The views expressed in this publication are those of the author(s) and not necessarily those of the UK Space Agency.

Contents

1. GLOSSARY

CSDDD Corporate Sustainability Due Diligence Directive

EO	Earth Observation
ESG	Environmental Social and Governance
EU	European Union
FS	Financial Services
GLEIF	Global Legal Entity Identifier Foundation
GS1	A not for profit community developing the Bar code and digital passport standards.
ISIN	International Securities Identification Number (ISIN) is a 12-digit alphanumeric code that uniquely identifies a specific security.
LEI	Legal Entity Identifier
OS	Ordnance Survey
TNFD	Task Force for Nature Based Financial Disclosures
TCFD	Task Force on Climate-related Financial Disclosures

2. Executive Summary

The UK Space Agency (UKSA), under the Unlocking Space for Business programme, has funded Ordnance Survey to identify the use cases, incentives and barriers for the adoption of Earth Observation (EO) data by the Financial Services (FS) industry.

Over two consecutive workshops we have gathered insights from leaders within the Financial Services sector and technology enablers who develop solutions, which will help provide insight into the needs of the sector and to identify the challenges around use and delivery.

This final report describes what have we done, and why have we done it. It recommends the next steps, articulates the high-level business case, and summarises recommendations for both Department for Science, Innovation & Technology (DSIT), Partners and UKSA.

The report discusses the background and workshop outputs. It highlights the specific pain points, and we test our resulting hypotheses by creating sample data and customer stories directly with the end users. Through this work we obtained clarity as to the role an entity such as OS should take in supporting the uptake of EO data for the FS industry, where we should start and stop and where the ecosystem should take over. We also co-created a theory of change with the industry which indicates what preconditions are necessary to enable the value of EO data to be derived.

As a result of this research, we believe there is a real opportunity for the UK to lead in the use of EO insights for financial reporting which would be transformational for the EO ecosystem. It has been articulated by the FS that one of the missing pieces is guidance and standardisation – what should the sector use, can they use it and can they trust it. Trust for location-based assessments is lacking and knowledge around the value that space assets can provide is often limited. The Task Force for Nature-based Financial Disclosures (TNFD) and other frameworks are trying to address this but ease of access, simple licensing terms, interpretation, and translation of data into insights is essential if we are to enable the uptake of space derived data.

Additionally, and where OS can play a significant role in unlocking the value of EO for FS, is the genuine issue articulated by the entire sector of lack of knowledge of asset location. This means that the markets are not connected to the physical world it is trying to invest in. This also means that that they cannot use EO data as effectively as they would want to as they do not know where to target their observations.

The theory of change (Figure 10) describes areas that UK could invest in, creating the pre-conditions to enable uptake such as:

- Access to authoritative data (e.g. the EO Data Hub)
- Standardisation
- Data fit for purpose and standardised pipelines for comparability
- Education and use cases
- Verified Asset location register
- Identifier linking (Fig. 11)
- Government as anchor customer.

This could enable the mass uptake of EO data, not only to support the existing and growing ecosystem, but also to provide inputs into ESG's, supporting the drive for NetZero and sustainable business.

Our role as a trusted, authoritative provider has been significant. The FS are all required to use best in class data and if these insights come from a trusted source, it is easier for them to use the data to meet regulatory requirements and their disclosures. They are currently spending millions on trying to navigate the data landscape with limited success primarily due to the financial sector not always having clarity around location of assets or the location of some of their customers.

We believe that if the issues outlined in this report could be solved, financial services outcomes and their products can be enhanced through the leveraging of EO data for monitoring and predictive analytics and decision-making.

3. Background

Ordnance Survey (OS) is Great Britain's national mapping agency. We carry out the official surveying of Great Britain (GB), providing the most accurate and up-to-date geographic data, relied on by government, business, and individuals. As a limited company, wholly owned by Government, and part of DSIT, we have unrivalled expertise in the collection, management, analysis and visualisation of geospatial data, exposing location intelligence to governments and businesses that enables them to achieve their sustainability, connectivity, growth and health/wellbeing priorities. Our services include consultancy, commercial product development and creating thriving geospatial innovation centres. We also provide data to over 5,000 public sector users through the Public Sector Geospatial Agreement and to the private sector via our partner channel. Geospatial data is recognised as a critical national infrastructure; it is the unifying foundations that connect vital data, ground it in the physical reality of our world, and turn it into actionable insight that accelerates sustainability, connectivity, growth, and health/wellbeing priorities. It is this ability to act on this insight that helps our customers accelerate their progress. This project aims to use this expertise to unlock the value of Earth Observation (EO) and Geospatial (Geo) data for use in financial services.

This SBRI project aims to understand how to unlock the value of the combination of geospatial, EO and Position, Navigation & Timing (PNT) capabilities for the financial sector, with the ambition to deliver on Return on Investment (ROI) for the UK space ecosystem and downstream services, and to drive societal impact and environmental protection through the appropriate use and access to EO derived data. For the purposes of this report, the Position element of PNT is addressed using geospatial data which provides both the position and context when combined with EO.

OS has been working with the UK space sector to understand how to support the use of EO data to our public and private sector customer base. Through supporting Space4Climate and utilising new space data such as that provided by GHGSat and SatVu, we have discovered key issues in a lack of awareness, understanding, and capabilities needed to access and interpret EO data to deliver actionable insights in the financial sector.

OS is in a unique position to support an aggregated approach to the use of geospatial and EO data. We can use our recognised global brand and trusted authority in location data to support the uptake of existing and less known EO products and services for the financial sector (FS). We have identified some key insights that can be applied to this project in terms of translating the value of space and how to collaborate on a global scale.

Definitions

Geospatial – relating to or denoting data that is associated with a particular location.

Earth Observation – the collection, analysis and presentation of information about planet Earth's physical, chemical and biological systems.

Position, Navigation & Timing - the technologies, systems, and processes used to determine 'how,' 'where,' and 'when'. Ordnance survey uses PNT capabilities in all our data capture, so when we refer to geospatial data, we also include PNT.

This report builds on the previous reports, which discussed the problem areas experienced by the financial services sector and explored data options and user stories. One key theme identified stems from the inability of the financial services sector to know the actual location of assets, investments or activity across the planet.

This is of concern to the sector as new frameworks such as Task Force for Nature Based Financial Disclosures (TNFD) are likely to become regulation in 2 years' time, and the new Corporate Sustainability Due Diligence Directive (CSDDD) reporting have requirements centred around knowing and understanding impact on the Earth. The European Union (EU) Deforestation Regulation is already causing concern in certain investments in supply chains, as ignorance is not defensible in the regulation (see annex 1 and 2 for some of the regulations highlighted in SBRI_Interim_Report_v1.1.docx). Those companies exposed to these new regulations are now exploring Earth Observation capabilities to test whether the capabilities can help with these new disclosures and to highlight areas of risk, such as deforestation activity. It is this demand that is also driving the want for better education and standardisation as there are multiple platforms and services that become non-comparable. This makes it extremely hard for the company to rely on or trust the outcome and could lead to challenge in court if models contradict in their output. In the UK, the Financial Conduct Authority could be encouraged to use EO capabilities to test claims or similarly the Bank of England could require the use in their stress testing. This is where they make sure banks, insurance companies and central counterparties are strong enough to withstand another financial crisis. So, we set them 'stress tests' to find out if they are prepared for the worst. There are concerns that the next financial crisis could be due to Climate change and asset stranding. The 2024 stress test included supply chains and geopolitical risk, some of which we already know are impacted by climate change and environmental harms, as summarised below (Figure 1).

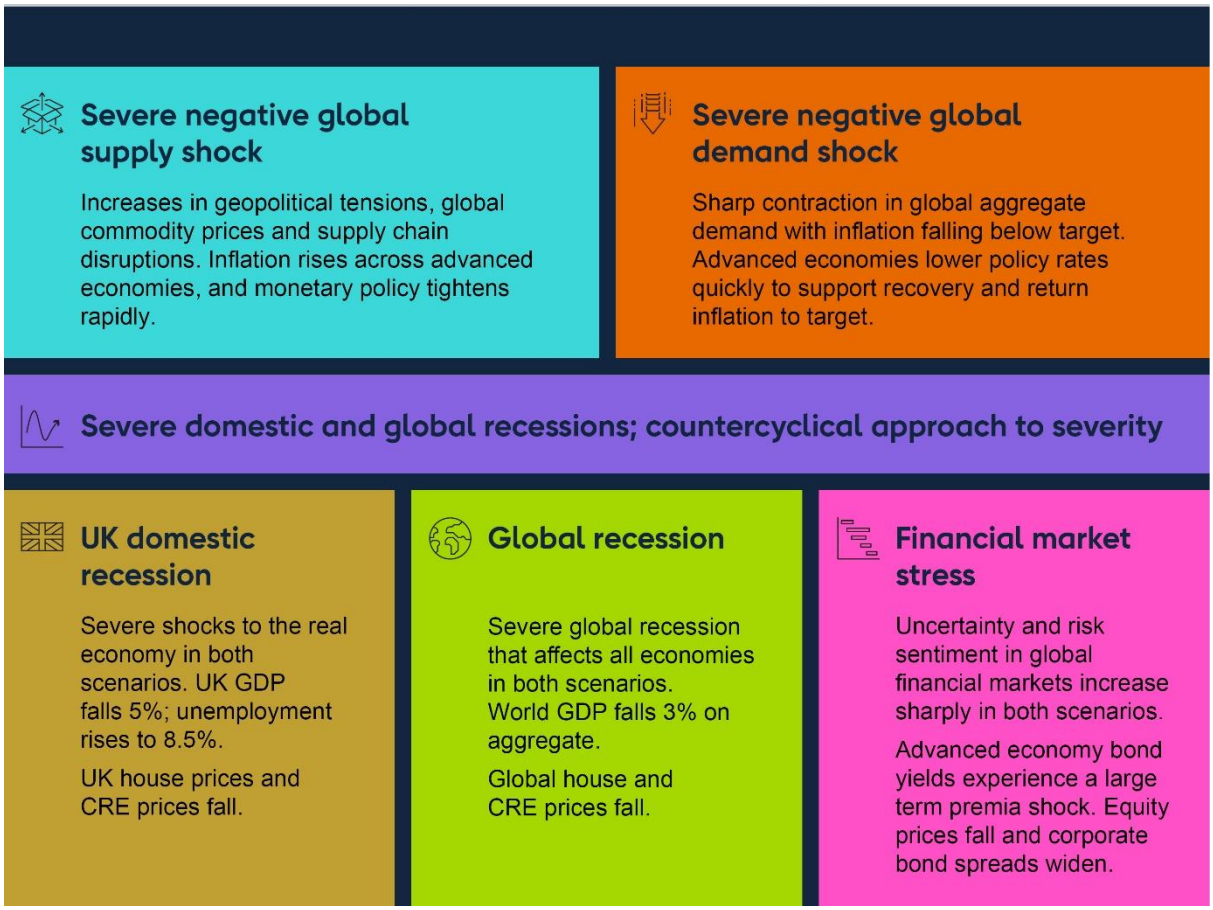


Figure 1: Bank of England 2024 stress test scenarios (Bank of England, 2024)

The risks of inaction are clear as not knowing can be an existential threat to business. It is therefore imperative that insurers analyse and understand how ESG risks can impact the policies they are underwriting and the issuers in their portfolios, and to strategically position themselves to benefit from ESG-related megatrends across their markets (Mukhopadhyay & Sánchez, 2023).

The latest UN analysis on global climate impacts describes the need for urgent action with 2023 being the hottest year on record amid rising sea levels and increased frequency and intensity of extreme weather. Economic losses from natural and climate related disasters are estimated to cost more than USD 330 billion per year, and this figure is just the tip of the iceberg of the real uncounted costs on people's lives (United Nations, 2024).

Additional analyses suggest that between 8% and 53% of the portfolios of the seven largest banks are exposed also to transition risks. Looking across the portfolios of the seven largest UK banks, the analyses indicate possible adjustments in the valuations of domestic holdings (excluding finance) of up to 4 – 5% over the coming decade from physical nature-related risks. Depending on the bank, the most at-risk sectors include agriculture, utilities, real estate and manufacturing. Firms could also derive opportunities from the nature-positive transition, including new demand for nature-positive products and services (Green Finance Institute, 2024).

As mentioned above, other issues that are commonly expressed by the financial services sector include **lack of interoperability and comparability between datasets**, with almost too many options of data without signposting or provenance.

"We are awash with data, but we don't know what to use effectively or how to use it appropriately"?

Some of these issues are highlighted in the SustainableFinance.live 2023 and Finextra reports, see Figure 2.

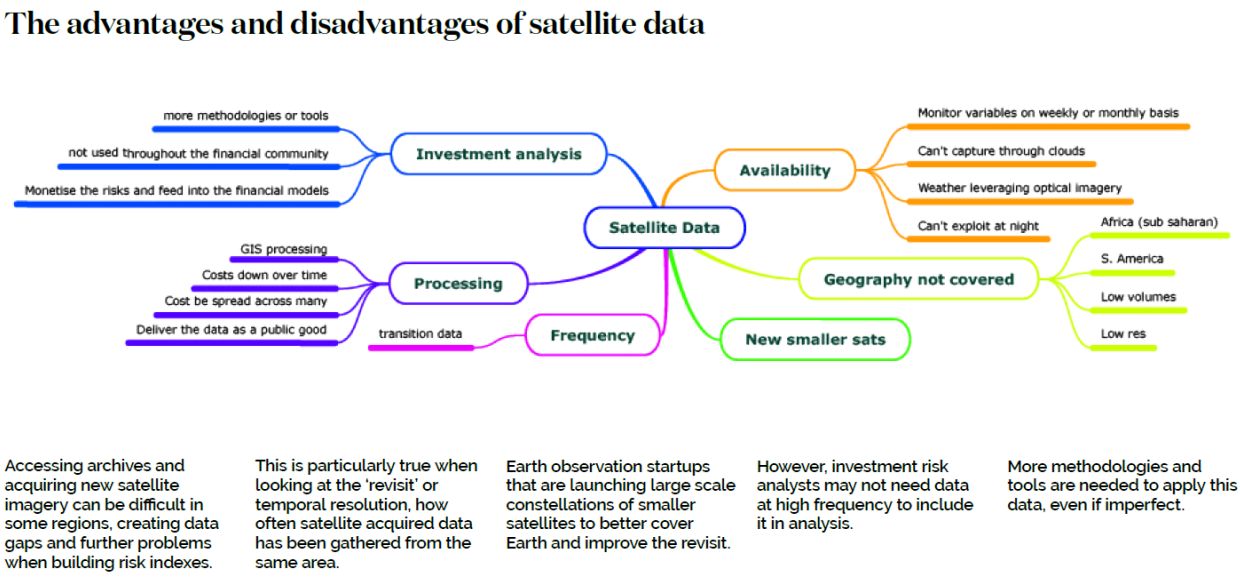
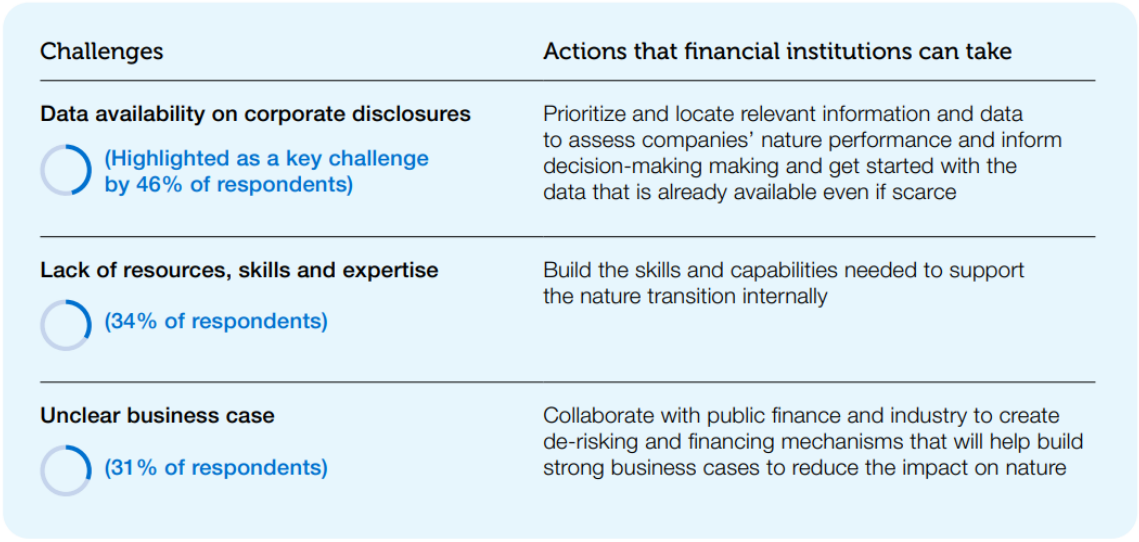


Figure 2: Advantages and disadvantages of EO data © SustainableFinance.live 2023 and © Finextra (Repsonsible RIsk, 2020)

There are **large gaps in terms of knowledge and understanding of what EO data can and cannot do to provide insight.** Participants at workshops indicated a real need to improve how we communicate the value of EO derived insights. They wanted to have use cases that could demonstrate the value of EO in terms of language that the FS sector can understand.



Challenges	Actions that financial institutions can take
Data availability on corporate disclosures (Highlighted as a key challenge by 46% of respondents)	Prioritize and locate relevant information and data to assess companies' nature performance and inform decision-making making and get started with the data that is already available even if scarce
Lack of resources, skills and expertise (34% of respondents)	Build the skills and capabilities needed to support the nature transition internally
Unclear business case (31% of respondents)	Collaborate with public finance and industry to create de-risking and financing mechanisms that will help build strong business cases to reduce the impact on nature

Figure 3: Barriers preventing financial institutions from taking action (Wyman, 2024).

There is a real **opportunity to improve the way we communicate the value** of EO, particularly through a shift of narrative to reflect the end user needs rather than the space sector technical inputs.

There is a critical need for the assurance of EO data used in reporting. The end users need to be able to use EO data to demonstrate appropriate levels of disclosure and are looking for standards and assurances that the data is suitable to use for mandated reporting purposes. This includes the need for certification and anchoring of data to trusted use cases. This could be a real opportunity for the UK to lead in the use of EO insights for financial reporting which would be transformational for the EO ecosystem.

The methane standard being led by UKSA was of great interest to both groups. The UKSA/UK government can help establish a 'gold' standard potentially with the Partnership for Carbon Accounting Financials (PCAF) or though the British Standards Institute (BSI). The National Physical Laboratory (NPL) could also be the vehicle for this as they have been assessing this previously in terms of appropriate use of EO data and the confidence in the data.

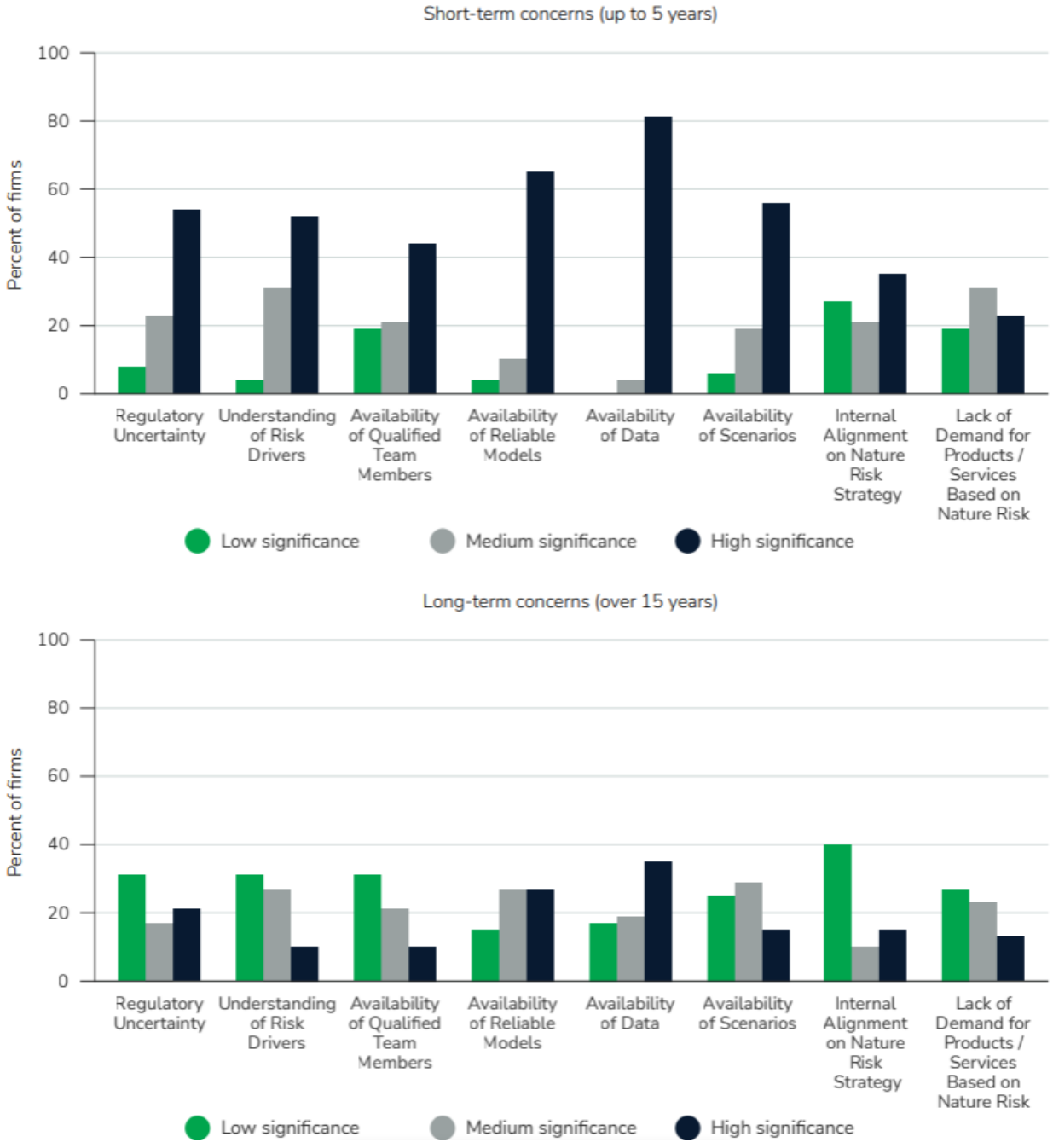
Standardisation and trust are both very significant for this sector and having a trusted body to provide the data, which is supported by government with academic rigour, was seen as valuable.

Another use case for the FS sector is the impact that nature loss has on the economy and is a source of significant risk for financial institutions. Moreover, nature's resilience is vital in the battle against climate change. Consequently, some regulators have already published formal guidelines for nature risk management, and nature related risks and opportunities are now being monitored closely by the boards of directors at many firms. When it comes to assessing and monitoring nature loss, the Global Survey of Nature Risk Management at Financial Firms (Paisley & Nelson, 2024) describes how the lack of data and information could be solved with the use of EO. The following tables from the report highlight the challenge, the nature risks which are related to specific FS sectors, and the frameworks being used to assess financial risk.

Figure 4 shows a range of other short- and long-term challenges. Availability of data and reliable models dominate both time periods. For more than half the firms, regulatory uncertainty, understanding the risks, and availability of scenarios are also highly significant short-term concerns. (These challenges are very similar to the concerns raised by firms in our climate risk survey.)

All concerns ease in the longer term. This indicates that firms expect more reliable data to become available, regulatory regimes to mature, and modeling approaches to become better established.

Figure 4 **Future Barriers and Challenges**



Credit risk is the most common risk type to embed nature risk into, followed by reputational risk, as depicted in Figure 15. Firms are planning on embedding it into all the traditional risk types – from operational risk to market risk and li Figure 4 l the insurance companies in the Survey have either embedded nature risk, or intended to embed it, within underwriting risks.

Figure 5 **Where Is Nature Risk Being Embedded?**

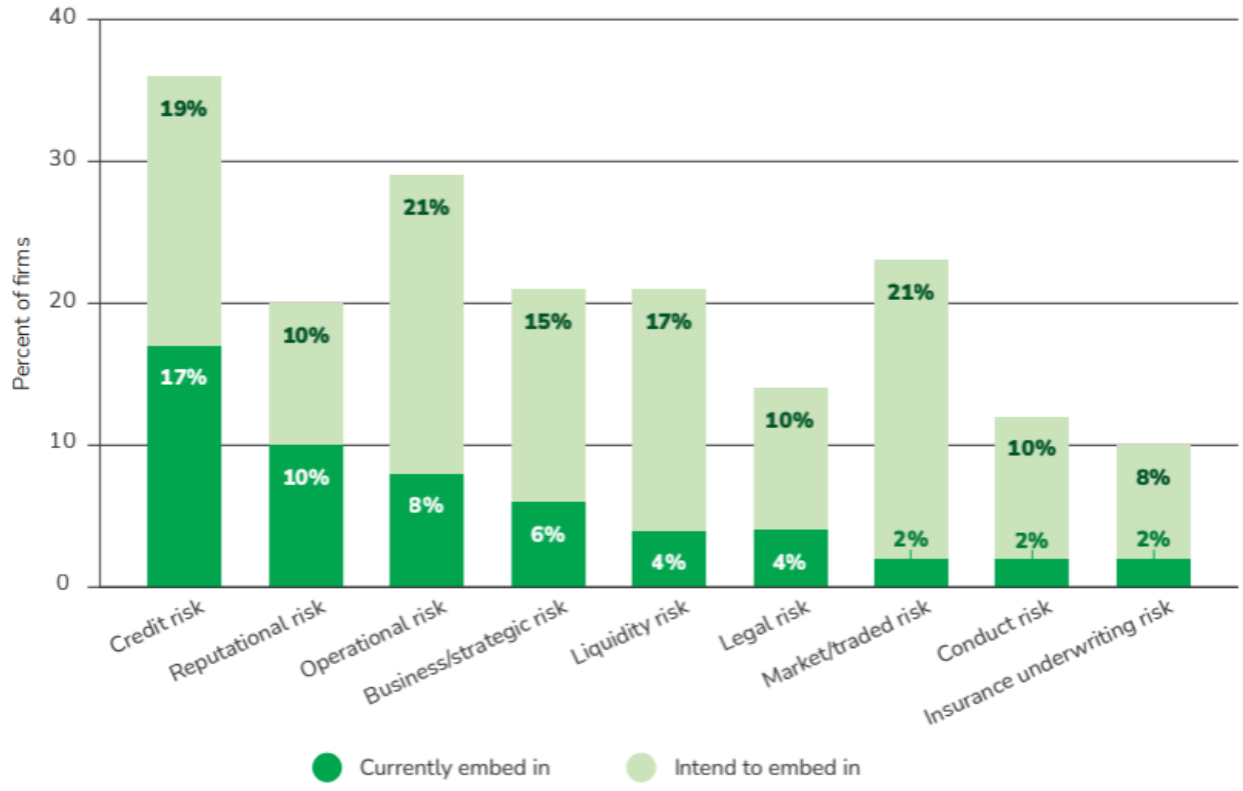


Figure 6 **Frameworks Used for Measuring Nature Risks**

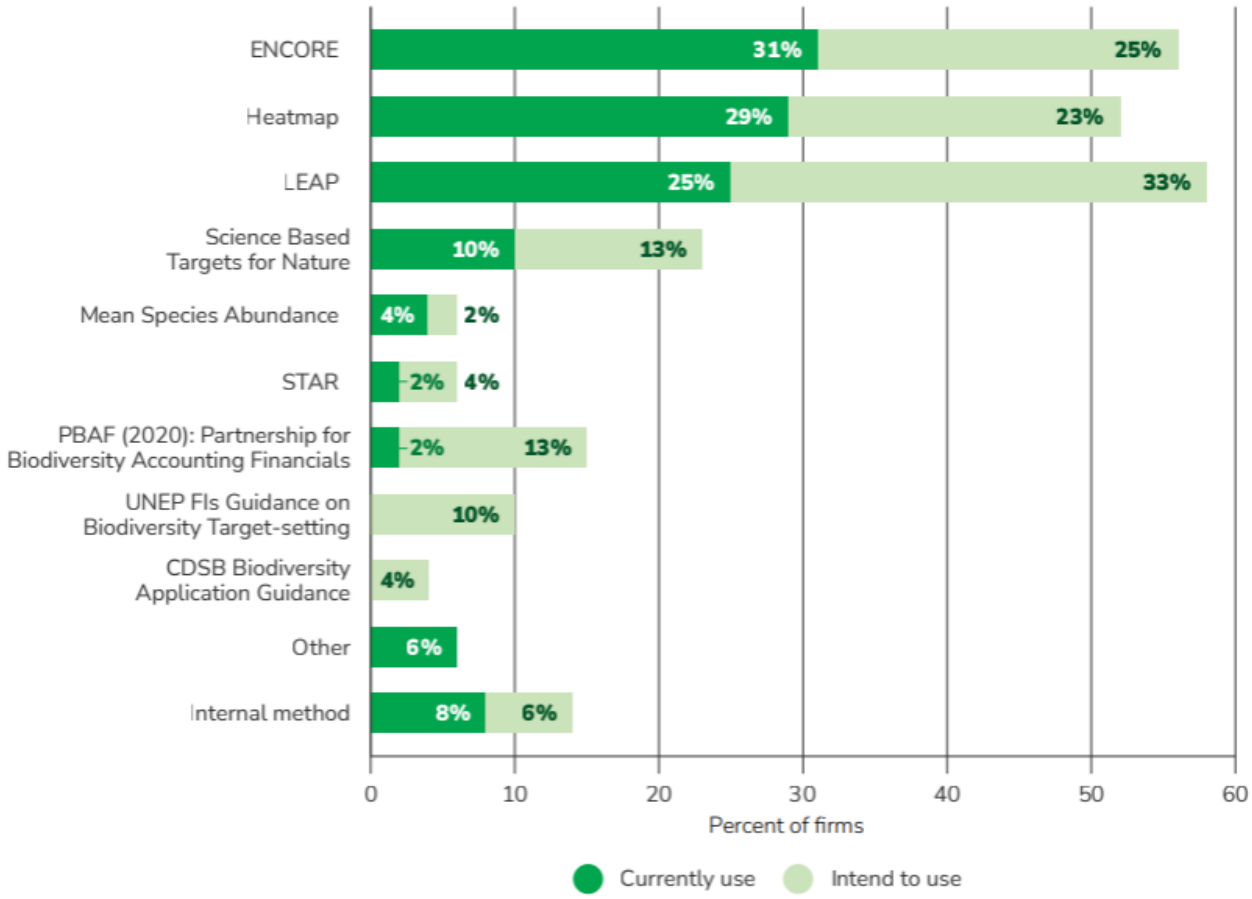


Figure 6 shows which frameworks are currently being used to assess nature-related financial risks. The most common ones are ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure), heatmaps, and TNFD's LEAP approach. Figure 1 5 also indicates which frameworks firms intend to which suggests these three frameworks look set to remain the most popula in the future.

4. Process

OS designed 3 workshops to engage with the sector, utilising our existing contacts from financial services organisations and system integrator communities; also leveraging OS's position as a trusted and authoritative organisation to reach out to new contacts. The first two workshops ran consecutively with 41 attendees in total and were focussed on understanding both the needs and barriers to uptake of EO data. We targeted a range of sectors and size of companies for the workshops

The first session targeted the FS sector with the aim to introduce them to the value of EO data and to understand where and how this could add value in their decision-making lifecycle. This workshop included decision makers from banks and investment funds, economists and a representative from DSIT (so they could hear directly from the end users). The attendees were primarily C-suite level. Many had to move previous commitments but were willing to do so as they saw this as a very important subject. Interestingly some who needed to attend other meetings halfway through stayed on, as they thought this was more important to them.

The second day workshop included systems integrators, consultants and companies that design the products and services for the financial sector. This session was aimed at discussing how the uptake of EO data within the FS sector could be improved and how these organisations could deliver added value for the end customer. Feedback from the day one workshop was provided for context.

For those who could not attend the first set of workshops, we held 1-2-1's.

The third workshop focussed on an assessment of the data outputs created from the feedback from the first two workshops. We designed two data trials to test with end users, testing hypotheses and results, and gathering direct feedback. We tested the user journey, business dependency, barriers, gaps and desirability. Importantly we also determined our role in providing EO services to the user. Participants were from the list of workshop 1 and 2 attendees, who were available and identified as interested for further discussions.

In request from participants, and with USKA permission, we also completed a final 4th workshop to expose our results and findings to systems integrators. The outcome of this work is collected in a series of reports and is summarised in Section 5.

5. Workshop outputs and Data Trials

The Financial Services sector has three key needs to address: risk, reward, and reporting.

Risk

Many in the sector need to understand vulnerabilities in their portfolios that could impact on return – this includes reputational impacts. Actuaries look at the worst-case scenario risks which tends to drive how much capital is needed to be set aside in case the risk materialises. This makes their output very important for strategies around managing portfolio risks, and their influence is often masked by the dominance of the insurance industry who act in response to risk. They are concerned that the models they currently use are not reflecting the risk of a rapidly changing world, the impact of which could have significant implications across the financial sector. Actuaries are particularly keen on future predictions, based on current patterns. They are aware that the world is beginning to enter unknown territory regarding climate change, so historic data may not provide the most up-to-date view or deliver the correct adjustments needed for transition planning and assets/portfolio protection. They need models that are created with more current data. Oxford university estimate the risk at $5trn for nature related economic risks alone[1].

Reward

The aim of the financial services sector is ultimately to deliver return for their clients and their business. They are beginning to see evidence of transition in the investment landscape, where old school investors, who have been happy to invest in oil & gas for example, are dying out and passing the money on to the next generation. This new generation appears more interested in sustainably linked investments, which is driving the industry to create new products that align with this new direction and opportunity. These types of investments will need objective evidence to show they are providing the expected impact. The FS sector must also adhere to rules around ‘greenwash'. Dark green impact investors (funds which have sustainable investment as their goal) must provide evidence that they are just that. Interestingly, this fund is outperforming the rest of the market. Participants saw advantages in using EO data to help get ahead of the markets and identify opportunities to invest. This would potentially help them perform better on what is called the Alpha, which is how they benchmark themselves in terms of portfolio investment performance. If EO can give them an edge on the Alpha, that is a huge win for them.

We were told that insurers are now assessing their portfolios against risk and finding it a better Return on Investment to invest in asset protection, such as flood prevention, rather than refuse to insure. In the UK, Flood Re have launched a 'Build Back Better’ scheme to help build resilience, funded by a Levy on all flood insurance.

Reporting

There is a new landscape of disclosures, regulations, and frameworks that the financial sector must align with (see SBRI_Interim_Report_v1.1). The main areas causing concern/problems are listed in Table 4.

[1] $5 trillion of nature-related economic risks will amplify climate change, says Oxford study | University of Oxford

Interestingly the TNFD, which is not currently regulatory, is still causing difficulty, possibly in anticipation of future regulation.

Example Framework, regulation, disclosure	***Concern/Problem***
Taskforce on Nature related financial Disclosures (TNFD)	Lack of asset level data, lack of data comparability, lack of metrics, coverage gaps, not mandatory, inconsistent
Task Force on Climate related financial disclosures (TCFD)	Location, speed of impact, granularity needed, standards, concern that UK is undertaking its own version for TCFD, inconsistent approaches and data used
ESG reporting	Lack of consistency and appropriate methodologies, different jurisdictional requirements, data collection is difficult (too many variable sources and is difficult to obtain at scale), based on reports
Emissions reporting	Scope 3 (emissions that are not produced by the company itself and are not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for up and down its supply chain), data quality (including poor metadata, currency, accuracy)

Table 4: Reporting concerns

The second workshop highlighted that the technology enablers also had limited knowledge about these frameworks, regulations, and were generally unaware of the concerns experienced by the customers. The only disclosure flagged was by a consultant who stated that the Corporate Sustainability Reporting Directive is causing real issues in terms of volumes of information required that is not in a readily accessible form.

We selected two use cases to take forward for data creation and visualisation to test our assumptions with the financial community and to assess what would be needed to assimilate the data into their systems and investment practices.

5.1 Opportunity areas for use of EO data in financial services

Out of the list provided as potential opportunity areas for the use of EO data, three were highlighted by the end users: Impact assessments, regulatory reporting and project finance. Project finance is a natural home for EO as location is often known as well as what needs to be measured. Project financing is designed for funding of long-term infrastructure, industrial projects, and public services using a non-recourse or limited recourse financial structure. The debt and equity used to finance the project are paid back from the cash flow generated by the project. For nature-based solutions, this is often in the form of carbon credits. The issue with Voluntary offsets is that you ignore information at your peril, as many corporations were caught out by the Guardian (Greenfield, 2023) Project finance is still small in terms of value. Impact assessments

and regulatory reporting are seen as far greater in terms of market value. One impact investor already buys data analytics that cost £2 million but only meets 30% of his data needs.

If the outputs from EO data can be standardised in a form that can be used by the sector, it will allow the investors to assess climate and environmental risks and identify opportunities (e.g. water scarcity vs drought and the implications for an asset) better. This would be seen as a great enabler for the transition that is needed for the financial sector.

Key area	Opportunity
Impact Assessments	Need to know location, environmental monitoring
Regulatory Reporting	Compliance monitoring, huge opportunity, understand risk
Project Finance	Trust, impact, show change over time, risks, and transition risks

Table 5: Opportunities for EO + Geospatial

Figure 7: Key Themes identified.

One of the recommendations was to use the Knowledge Management Cognitive pyramid (Figure 8) from Geospatial World as a framework to move from data to wisdom. One could argue from an Industry point of view we are at the information stage as outputs are not consistent enough to create knowledge for financial services.

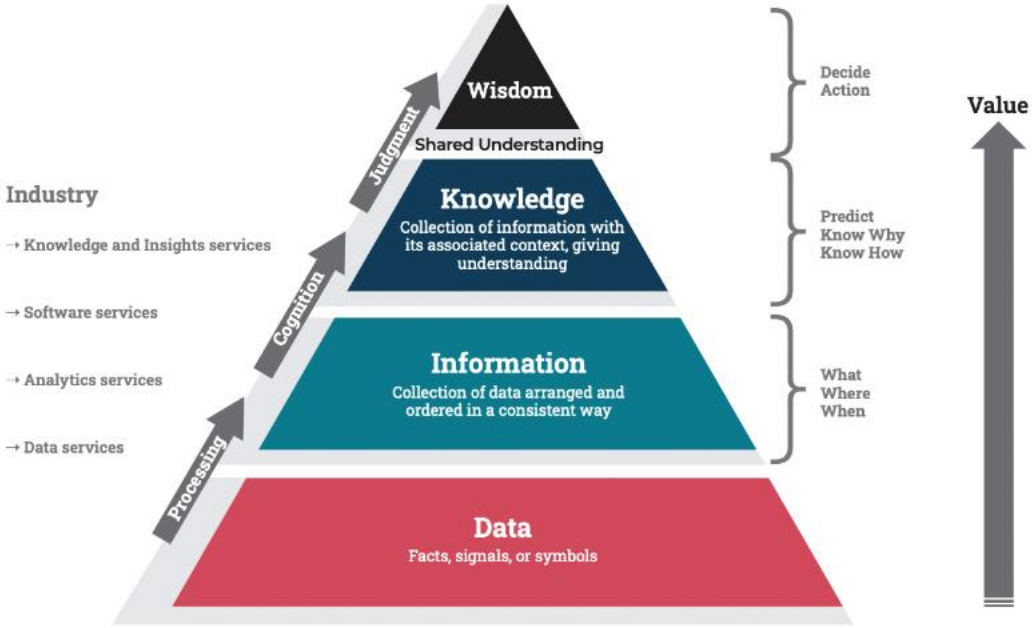


Figure 1: The Knowledge Management Cognitive Pyramid demonstrates the relationship between data and knowledge. 4IR technologies increasingly enable knowledge to be generated 'automatically', improving decision making and adding value.

Source: Adapted from DIKW Model for Knowledge Management and Data Value Extraction

Figure 8: Knowledge Management Cognitive Pyramid (Datta, 2022)

5.2 Benefits of approach

An unexpected benefit of the approach taken where we asked their pain points first, then took them through the EO capabilities and returned to their pain points and potential use cases, seemed to enable a much deeper and broader conversation and understanding within the group. The outcome was the immediate uptake of EO capabilities within one of the large impact investors product portfolios to demonstrate their deep green credentials and to differentiate themselves, to two new start-ups being created by FS professionals who were not EO users but saw the value in using EO data insights to support FS due diligence and monitoring of their portfolios.

6. Use cases

After reviewing all the use cases identified (see SBRI_User_Stories_Report_V2), two were selected to take forward for data creation and visualisation to test our assumptions with the financial community and to assess what is required to assimilate the data into their systems and investment practices.

Initial user stories identified from the workshops were:

Figure 9: Initial user stories

The user stories were analysed in terms of the activity needed to build data outputs that could support them. Two key use cases were chosen based on the time available to create the sample data for testing with the end users. The aim was to primarily test whether we had understood their needs and what role OS could have in helping them with their pain points and jobs in accessing EO data. They were focused on the area highlighted in red in this slide and diagram provided by Aviva (Figure 10) which outlined the financial system and how it connects with individuals.

Figure 10: EO data focus areas

The two use cases identified for testing were:

- As an **owner of national (road, rail, power, pipes) infrastructure**, I want to **communicate the current and future risk and revenue of my assets to my investors** (and show other stakeholders how the ecological impact of doing so will be managed and minimised) so that **I can fund and manage the transition of those assets into a more climate-resilient state**. Supports infrastructure bonds.

- As an **investor in property**, I want to **understand the risk of climate-related effects associated with different sites and properties**, so that I can **make informed investments and balance risk with reward**. Supports Green Loans, Social bonds project finance.

  As part of this work a logical data model was also created by our data architect, one that could enable future additional use cases (Figure 11, see Annex 3 for more detailed information**)**:

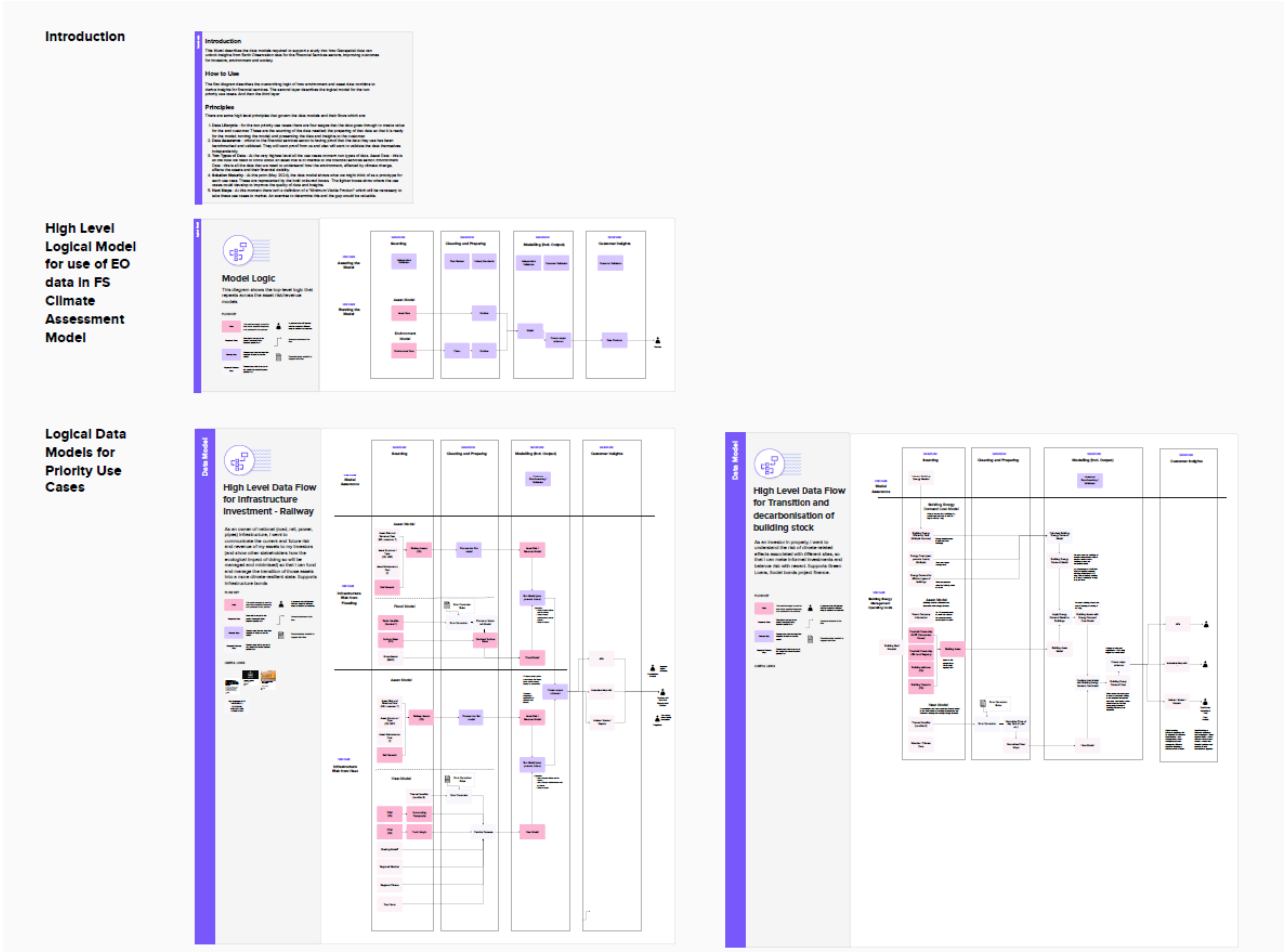


Figure 11: Logical data model for use cases

6.1 Customer journey feedback

We took the end users through the data and customer journey to test our thinking, identify any gaps and understand where they felt OS's role should start and stop with the enablement of EO data usage. This led to some very interesting debates particularly around the data gap of asset location, where the group felt OS could have a key role to play. Without the asset location identification, the group thought that EO data could not be used for the outcome needed. Interestingly, in both cases they also saw a role for OS in supporting existing metrics available from EO applications/services. They believed this could enable the growth for the sector if location became part of the core offer for metric analytics.

It was also recognised that the ecosystem is already awash with metrics, that are non-comparable and are inconsistent, so standardisation and easier access and licensing regimes could help the financial services adopt EO metrics.

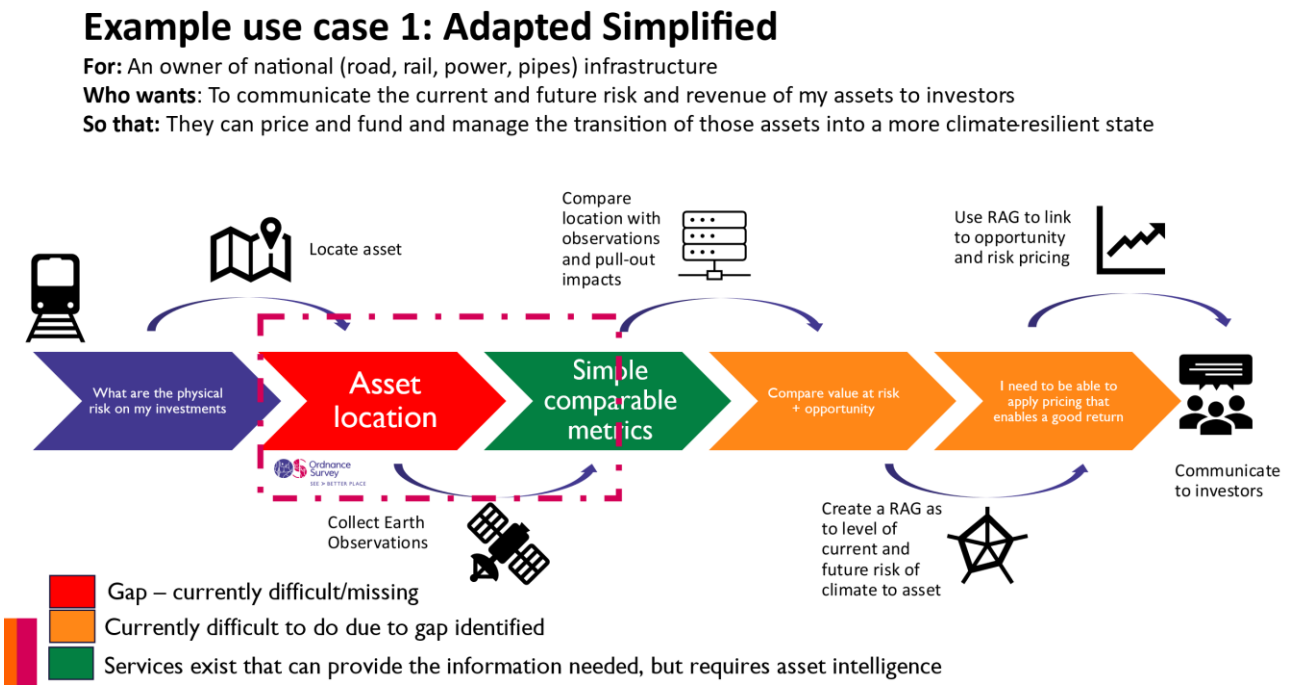


Figure 12: Use case 1 customer journey.

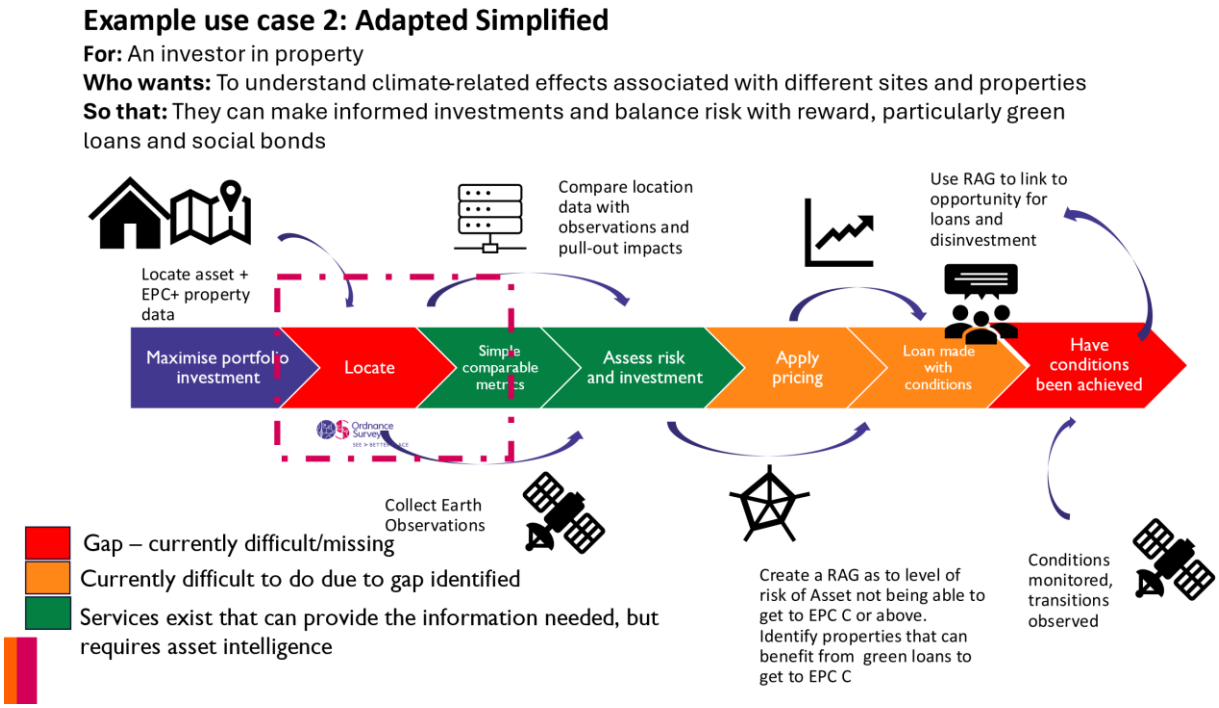


Figure 13: Use case 2 customer journey.

6.2 Business dependency network

As part of one of the workshops, we also tested the business drivers for adoption of EO data services by the financial sector so we could then identify the key reasons for the use of EO across the industry. Figure 14 below shows the relevance of EO data for the identified business drivers.

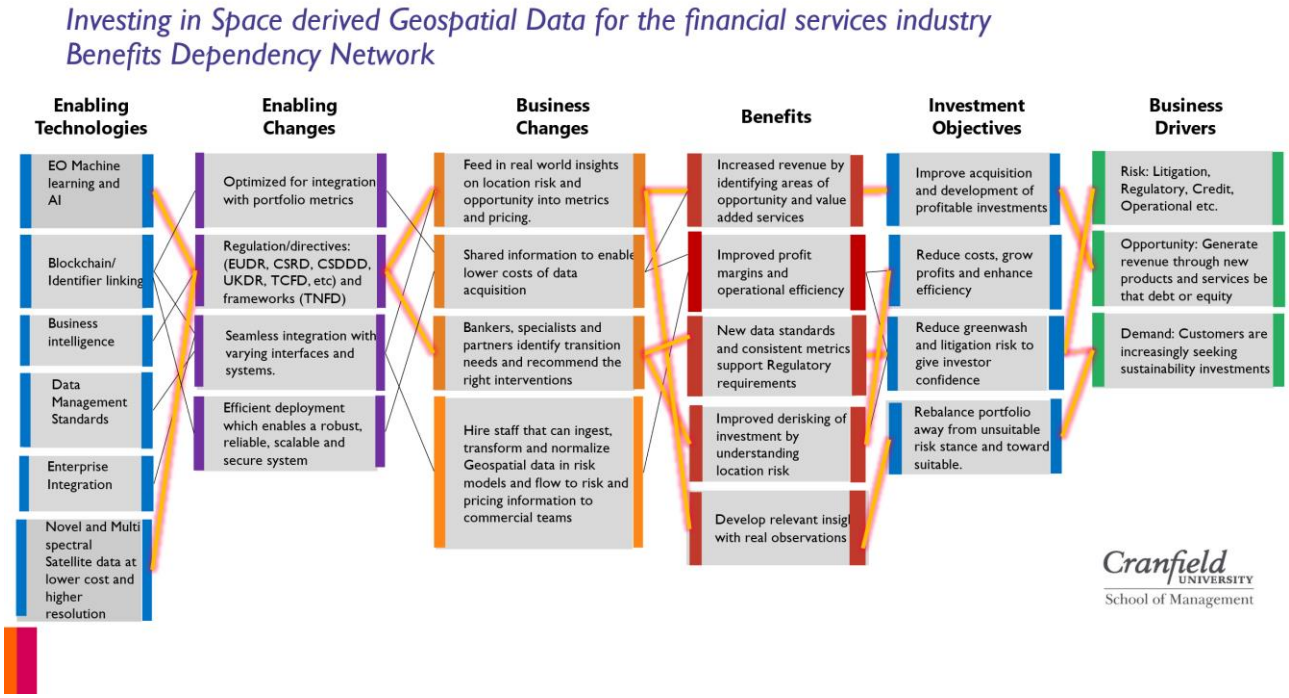


Figure 14: Business dependency framework for adoption of EO

Interestingly, participants (which represented Entrepreneurs, Retail banks, Financiers, standards, actuaries, and challenger banks) felt that the business drivers ignored the overarching need for transition to sustainable business practice. We therefore subsequently created a theory of change to capture the discussion and desire to drive the transition necessary, through the identification of the relevant levers.

This was designed to reflect their primary concerns and focus on the:

- Gap between data sources and actionable information.
- Disparate sources of data, commercial access restrictions, the fact that data is often not in a form ready for analysis and a lack of objective information to judge fitness for purpose.
- Inability to exploit services, data and expertise developed around the Copernicus programme.

The key role for OS and the EO ecosystem can be seen in the inputs line in Figure 13, but there are also key roles for OS, the EO ecosystem and the government to create the preconditions necessary to enable uptake, such as access, education, fit for purpose data and standardisation.

Theory of Change diagram definition

A theory of change diagram defines the necessary and sufficient conditions considered as being required to bring about a given long-term outcome. It requires people to think in backwards steps from the long-term goal to the intermediate and then early-term changes that would be required to cause the desired change.

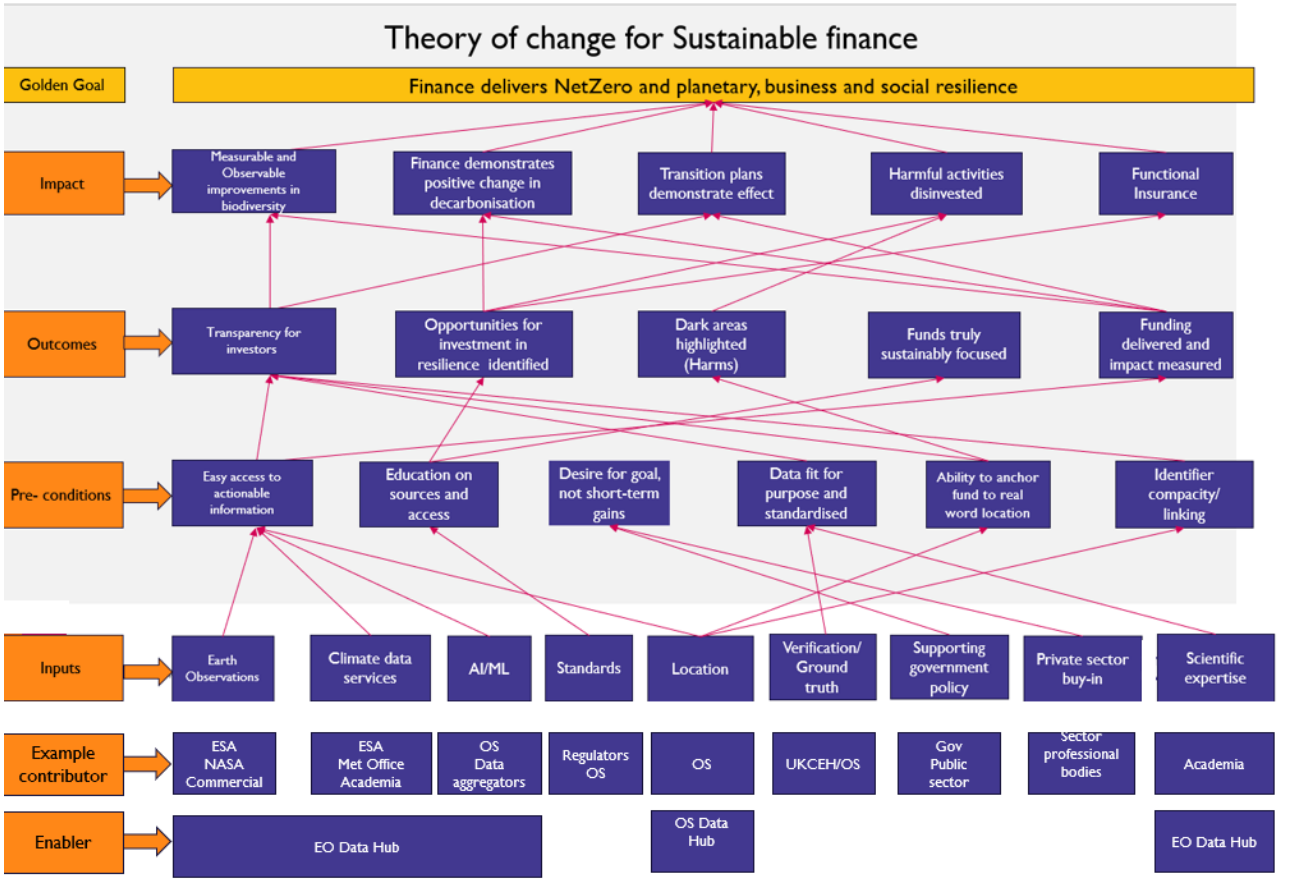


Figure 15: Theory of change for Finance to deliver NetZero and global resilience.

7. International outputs

As part of our research, we wanted to understand what international use cases could help indicate where barriers have already been overcome or provide valuable material to demonstrate real use cases for the financial sector to understand the applications.

The International Report (International Use cases Report- v0.2) presents a series of international use cases, illustrating the pivotal role of geospatial technologies in various sectors such as water utilities, agriculture insurance, energy supply chain, investment services, agriculture and water management, real estate, global trade, and oil and gas. These use cases underscore the versatility and capacity of these technologies to support a transition towards a more sustainable and resilient economy.

The strategic application of geospatial data is enabling investors, policymakers, and businesses to visualize and quantify the environmental and societal dimensions of their decisions, globally. By leveraging location intelligence and integrating EO data, organizations gain a bird's-eye view of the physical world, translating into actionable insights that underpin risk management and investment strategies aligned with Environmental, Social, and Governance (ESG) criteria.

The use cases presented in this report demonstrate the transformative potential of Spatial Finance and AI-Location Intelligence across various services in the financial sector demonstrated in the below table and findings section.

Information on relevant international regulation and standardisation is listed in Annex 1 of the report.

Another notable development is the use of advanced satellite technology to augment the capabilities of these tools, with companies such as CLIMATIG conducting physical risk assessments at a detailed 10-meter resolution. Complementing this, some risk assessment platforms are integrating FEMA maps. The latest generation of these maps deliver geospatial hazard data for North America with remarkably brief time lags. Furthermore, most tool vendors are streamlining the user experience by offering cloud based, real-time dashboards and portals, which adds yet another layer of convenience and efficiency (UN Environment programme finance initiative) (Carlin, et al., 2024).

8.1 Use Cases Summary Table

No	Use case Name	Entity Sector	Entity Name	Analyst Name	Service
1	Financial Performance Assessment: The US Water Utilities Financial Health analysis	Water Utilities	US Public water Utilities	S&P Global	Financial performance assessment
2	Insurance for Agriculture: Validation of hailstorm events in Macedonia	Insurance for Agriculture	Macedonian Insurance Company	EOS Data Analytics (EOSDA)	Enhance insurance accessibility and validate claims
3	Investment in Energy Supply Chain: Energy Management for ESG Investment and operations	Energy Supply Chain	ESG Energy investment groups, market analysts, global energy operators and regulators, etc.	European Space Agency (ESA) and Terrabotics	Sustainable investments in energy supply chain management
4	ESG Investments & Risk Solutions: Partnership for Financial Risk Assessment Firm collaboration with high-cadence geospatial data provider	Investment Services	Moody's	Planet Labs PBC	Risk assessment as a part of investors financial services
5	Investment in Agriculture: Enhancing Financial Services for Smallholder Farmers and (Agro)-Pastoralists	Agriculture and Water Management	Netherlands Space Office	Various public-private partnerships facilitated by the Netherlands Space Office	Supporting private investments in agriculture with actionable advice and financial services, including insurance and financing.

6	Asset Management in Real Estate: Enhancing ESG Investment Strategies with Spatial Finance and Location Intelligence	Real Estate	Real Estate Asset Managers; Chief Heat Officers, Environmental Engineers, Urban Planners	FortyGuard	Transform real estate asset management operations and property listings by integrating microclimate insights.
7	Sustainable Global Trade: Marine Traffic Data Services to sustainable trade flow	Global Trade	Financial institutions, commodity traders, and other stakeholders	Kpler's team of experts	Provide a comprehensive view of global trade and supply chain dynamics with granular detail & analysis on emissions, commodity, fleet, etc.
8	Sustainable Metal Mining: Ghana Artisanal Gold Mining Environmental Impact	Metal Mining & Environmental Monitoring	Ghana Government	Researchers and institutions in the United States and Ghana	Analyse land use to estimate the transition of vegetation to mining, both at large and small scales and create climate vulnerability analysis models for use by the Government of Ghana.

Table 6: Use Case Summary

8.2 Findings

The use cases internationally seem to be growing based on the need to gather insights. There is wider international use due to the lack of data infrastructure in some locations. Where available, geospatial data, remotely sensed data from novel missions like greenhouse gases mission and heat maps, along with location intelligence technologies have a profound impact on financial services. It empowers financial institutions to optimize resource allocation, enhance operations and plan future investments strategically with alignment to ESG indicators and net-zero objectives. Moreover, it provides a comprehensive understanding of operations and the surrounding environment, which is crucial for making informed decisions and risk management.

Sectors: The use cases selected from different **sectors** that have adopted these technologies include water utilities, agriculture insurance, energy supply chain, investment services, agriculture and water management, real estate, global trade, and oil and gas. This wide range of sectors underscores the versatility of geospatial technologies.

Services and common themes: The **services** provided through the use of these technologies include financial performance assessment, insurance accessibility and claim validation, sustainable investments in energy supply chain management, risk assessment as part of investors' financial

services, support for private investments in agriculture, transformation of real estate asset management operations, provision of a comprehensive view of global trade and supply chain dynamics, and navigation of the challenges of climate change and regulatory pressures.

Datasets: The use cases leveraged various geospatial and EO **datasets**, including satellite data, Greenhouse Gases (GHGs) Mission, heat data maps, machine learning, Satellite Data Acquisition, Data Processing, Module Development, Geodata, FortyGuard's Temperature Operating System (tOS), AIS (Automatic Identification System) data, historical insights, predictive analytics, and a comprehensive ship database including emission intelligence solutions.

8.3 Additional Lessons learnt (GLEI conference and ML4EO)

The Global Legal Entity Identifier conference with the financial services sector, held on 8/07/24, made it very clear that the drive for transparency and comparable data is critical for the financial sector. The International Chamber of Commerce Global Policy lead stated that all the companies within their membership are seeing the current issues of incomparable data and increasing requirements to know detailed information on their impact is now an existential threat to business as fines and risks are now in the $ billions.

There was a recognition that EO and other data was available to help but without knowing where their investments are, it is very hard for them to apply it. Legal identifiers help provide trust between legal entities but that does not help with knowing where their impact on the environment, society or climate exposure risks are.

The Machine Learning for EO conference (ML4EO) was primarily attended by science and technology leaders in AI and ML. The big insight however was that the processing pipeline to enable the use within AI or ML models took days and is very time consuming and expensive. It seemed to be the largest constraint to uptake from business. It also means that each entity potentially has its own way of processing the data, making the model outputs non comparable. This is an issue if the data or insights are to be used for decision making that can be challenged, especially when large scale funding is at risk.

Standardization of processing pipelines, the derivation of consistent quality metrics and confidence levels for the outputs could help alleviate this issue. The EO data Hub has a specific workstream with the National Physical Laboratory to assess this specific requirement.

10. Conclusion

This is a real opportunity for the UK to lead in the use of EO insights for financial reporting which would be transformational for the EO ecosystem.

The new reporting landscape for the financial and corporate sectors (highlighted in SBRI_Interim_Report_v1.1) is a minefield of interconnected frameworks, regulations, and disclosure, both mandatory and voluntary. Below, we have tried to illustrate the complexities they face, but in complexity there is also the opportunity for EO data to be used as a golden thread that can underpin risk assessments necessary for the disclosures. We believe that the missing piece is guidance and standardisation – what should the sector use, can they use it and can they trust it. Trust for location-based assessments is lacking and knowledge around the value that space assets can provide is often limited. The Task Force for Nature-based Financial Disclosures (TNFD) and other frameworks are trying to address this but ease of access, simple licensing terms, interpretation, and translation of data into insights is essential if we are to enable the uptake of space derived data.

A genuine issue articulated by the entire sector is lack of knowledge of asset location. This means that the markets are not connected to the physical world it is trying to invest in. This also means that that they cannot use EO data as effectively as they would want to as they do not know where to target their observations.

Looking back at the theory of change (Figure 15) the UK could invest in creating the pre-conditions to enable uptake:

- Access to authoritative data (e.g. the EO Data Hub)
- Standardisation
- Data fit for purpose and standardised pipelines for comparability
- Education and use cases.
- Verified Asset location register
- Identifier linking (Figure 14)
- Government as anchor customer

This could enable the mass uptake of EO data not only to support the existing and growing ecosystem, but also to provide inputs into ESG's, supporting the drive for NetZero and sustainable business.

In conclusion, shifting to spatial finance through the integration of geospatial and Earth Observation data, coupled with novel missions like Greenhouse Gas (GHG) missions and trusted location intelligence could revolutionize various sectors by driving efficiency, sustainability, and informed decision-making.

If the issues outlined in this report could be solved, financial sustainable performance can be enhanced through the leveraging of EO data for predictive analytics and decision-making. Insurance validation and accessibility can be greatly improved by using location intelligence to assess risk accurately and promptly. Additionally, small private investments, particularly in agriculture, can be supported with actionable insights derived from EO data.

Sustainable investment in energy supply chains and metal mining can also be promoted by using EO data to monitor environmental impact and assuring compliance with sustainability standards. Real estate asset management can be transformed by integrating microclimate insights and other geospatial data into property valuation and market trend analysis.

Moreover, a comprehensive view of global trade and supply chain dynamics can be provided with granular detail by using Automatic Identification System (AIS) location technology and EO data to monitor shipping routes, emissions, commodities, and fleets. This will optimize operations, help direct ESG investments and support policy development.

These advancements can drive efficiency, sustainability, and informed decision-making, thereby shaping the future of the financial sector.

As a result of this research, we have a clear understanding of the key benefits in OS' involvement in supporting the uptake of EO data. Our role as a trusted, authoritative provider has been significant. The FS are all required to use best in class data and if these insights come from a trusted source, it is easier for them to use the data to meet regulatory requirements and their disclosures. They are currently spending millions on trying to navigate the data landscape with limited success primarily due to the financial sector not always having clarity around location of assets or the location of some of their customers.

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Annex 1 - A complex framework, disclosure, and regulatory landscape: extracted from SBRI_Interim_Report_v1.1.docx

The new reporting landscape for the financial and corporate sectors is a minefield of interconnected frameworks, regulations, and disclosure, both mandatory and voluntary. Below, we have tried to illustrate the complexities they face, but in complexity there is also the opportunity for Earth Observation (EO) data to be used as a golden thread that can underpin risk assessments necessary for the disclosures. We believe that the missing piece is guidance and standardisation – what should the sector use, can they use it and can they trust it. Trust for location-based assessments is lacking and knowledge around the value that space assets can provide is often limited. The Task Force for Nature-based Financial Disclosures (TNFD) and other frameworks are trying to address this but ease of access, simple licensing terms, interpretation, and translation of data into insights is essential if we are to enable the uptake of space derived data.

1.1 Disclosures

There are some key disclosure requirements that will likely drive the need for improved uptake of EO data.

1.1.1 European Union

Corporate Sustainability Reporting Directive

Starting in 2025, the European Union will require large and listed companies to disclose information on risks and opportunities related to their Environmental, Social, and Governance (ESG) practices, with a particular focus on the impact of their activities on people and the environment. The Corporate Sustainability Reporting Directive (CSRD) replaces the EU's legacy ESG reporting program—the Non-Financial Reporting Directive (NFRD) — and raises the requirement bar for breadth and robustness in sustainability reporting, covering categories beyond just carbon, including pollution, water, waste, and biodiversity. The CSRD's technical rules known as the European Sustainability Reporting Standards (ESRS) lay out what companies will need to disclose and how. Disclosures on these topics will need to exist in annual reports alongside financials and will also be subject to audit assurance.

The CSRD applies to:

- Large, listed companies, banks, and insurance companies already subject to the NFRD
- Other listed EU companies
- Listed European SMEs
- Large private European companies
- Non-European companies with significant business in the EU

The EU Deforestation Regulation

On 29 June 2023, the Regulation on deforestation-free products entered into force.

Under the Regulation, any operator or trader who places commodities on the EU market, or exports from it, must be able to prove that the products do not originate from recently deforested land or have contributed to forest degradation. This applies to the production of commodities such as cattle, wood, cocoa, soy, palm oil, coffee, rubber, and some of their derived products, such as leather, chocolate, tyres, or furniture.

The Regulation on deforestation-free products repeals the EU Timber Regulation. As of 29 June 2023, operators and traders will have 18 months to implement the new rules. Micro and small enterprises will enjoy a longer adaptation period, as well as other specific provisions.

It aims to

- avoid that the listed products Europeans buy, use and consume contribute to deforestation and forest degradation in the EU and globally
- reduce carbon emissions caused by EU consumption and production of the relevant commodities by at least 32 million metric tonnes a year
- address all deforestation driven by agricultural expansion to produce the commodities in the scope of the regulation, as well as forest degradation

1.2 UK disclosures

1.2.1 Task Force for Climate related Financial Disclosures (TCFD)

The Task Force for Climate related Financial Disclosures (TCFD) was designed to enable more effective climate-related disclosures to promote more informed decisions and, in turn, enable stakeholders to understand better the concentrations of carbon-related assets and exposures to climate-related risks.

The TCFD recommendations are being adopted more broadly in international sustainability standards (e.g., sustainability standards from IFRS Foundation's International Sustainability Standards Board (ISSB) and the International Public Sector Accounting Standards Board (IPSASB). Adopting TCFD recommendations ensures that the UK public sector is following global best practice.

The UK government formally endorsed the TCFD framework and has mandated TCFD-aligned disclosure for large entities in the UK private sector. it is organized around the four core TCFD pillars: governance, strategy, risk management, and metrics and targets.

Table 1: TCFD's Supplementary Guidance for financial sector and non-financial groups (source Task Force on Climate-related Financial Disclosure (TCFD) -aligned disclosure application guidance - Phase 1 - GOV.UK (www.gov.uk))

		Strategy			Risk Management			Metrics and Targets		
	Industries and Groups	a)	b)	c)	a)	b)	c)	a)	b)	c)
Financial	Banks	■			■			■		
	Insurance Companies		■	■	■	■		■		
	Asset Owners		■	■	■	■		■	■	
	Asset Managers		■		■	■		■	■	
Non-Financial	Energy		■	■				■		
	Transportation		■	■				■		
	Materials and Buildings		■	■				■		
	Agriculture, Food, and Forest Products		■	■				■		

Please note there is no Supplementary Guidance for the Governance recommended disclosures. Source: www.fsb-tcfd.org/publications/

Entities subject to TCFD-related (or similar) legislation or regulation

- Publicly quoted companies, large private companies and LLPs should check the BEIS Mandatory climate-related financial disclosure.
- Premium-listed and standard-listed companies should check the Financial Conduct Authority (FCA) Listing Rules.
- FCA-regulated companies should check the FCA Climate-related Disclosure Rules. Relevant types of entities include:
- asset managers
- life insurers (including pure insurers)
- non-insurer FCA-regulated pension providers, including platform firms and Self-invested Personal Pension (SIPP) operators
- FCA-regulated pension providers

Voluntary adoption

Applying the TCFD recommendations provides various benefits to both reporting entities and report users. As a result, public sector bodies may choose to voluntarily apply this guidance - in full or in part.

Where a reporting entity is significantly impacted by climate-related issues, they should consider the need for TCFD disclosure – even where they do not meet the specific criteria for mandatory disclosure laid out in

this section. In addition to increased transparency to key stakeholders across the four pillars, the related disclosure provide management with decision useful information.

Where an entity's policy or regulatory remit is heavily influenced by or has a significant influence on climate change, they should also consider whether disclosure is appropriate based on the informational needs of their annual report users.

1.2.2 Sustainability Disclosure Standards (SDS)

UK Sustainability Disclosure Standards (SDS) will set out corporate disclosures on the sustainability-related risks and opportunities that companies face. They will form the basis of any future requirements in UK legislation or regulation for companies to report on risks and opportunities relating to sustainability matters, including risks and opportunities arising from climate change.

UK SDS will be based on the IFRS® Sustainability Disclosure Standards issued by the International Sustainability Standards Board (ISSB), by July 2024. UK endorsed standards will only divert from the global baseline if absolutely necessary for UK specific matters. Following endorsement, UK SDS may be referenced in any legal or regulatory requirements for UK entities.

By using the IFRS Sustainability Disclosure Standards as a baseline, the aim is for the information companies disclose under UK SDS to be globally comparable and decision-useful for investors. The disclosures required by these standards will help investors to compare information between companies, thereby aiding decision making; supporting the efficient allocation of capital, and smooth running of the UK's capital markets.

Note – add background. The FRC regime aims to tackle deforestation by making it illegal for larger businesses operating in the UK to use key forest risk commodities produced on land illegally occupied or used, with in-scope businesses required to undertake due diligence and report on this exercise annually. Secondary legislation to implement these requirements in the UK is likely to be adopted early in 2024. These requirements will sit alongside the EU Deforestation Regulation, which will impose due diligence obligations for the EU market from 30 December 2024 aimed at tackling deforestation and forest degradation.

The UK Government has confirmed that the full list of commodities in-scope of the FRC regime is as follows: non-dairy cattle products (beef and leather), cocoa, palm, and soy (and any products derived from them). Notably, this list does not include coffee and rubber which are covered by the EU regime. It also does not include timber products which will remain subject to the existing UK Timber Regulations.

Organisations using these commodities in UK supply chains with a global turnover of more than £50m will be in scope of the regime.

These businesses will be banned from using regulated commodities if sourced from land used illegally. They will also be required to undertake a due diligence exercise on their supply chains and to report on this exercise annually for transparency.

Organisations whose use of the in-scope commodities does not exceed the annual volume threshold of 500 tonnes may submit an exemption. There will also be a grace period for organisations (whether directly in-

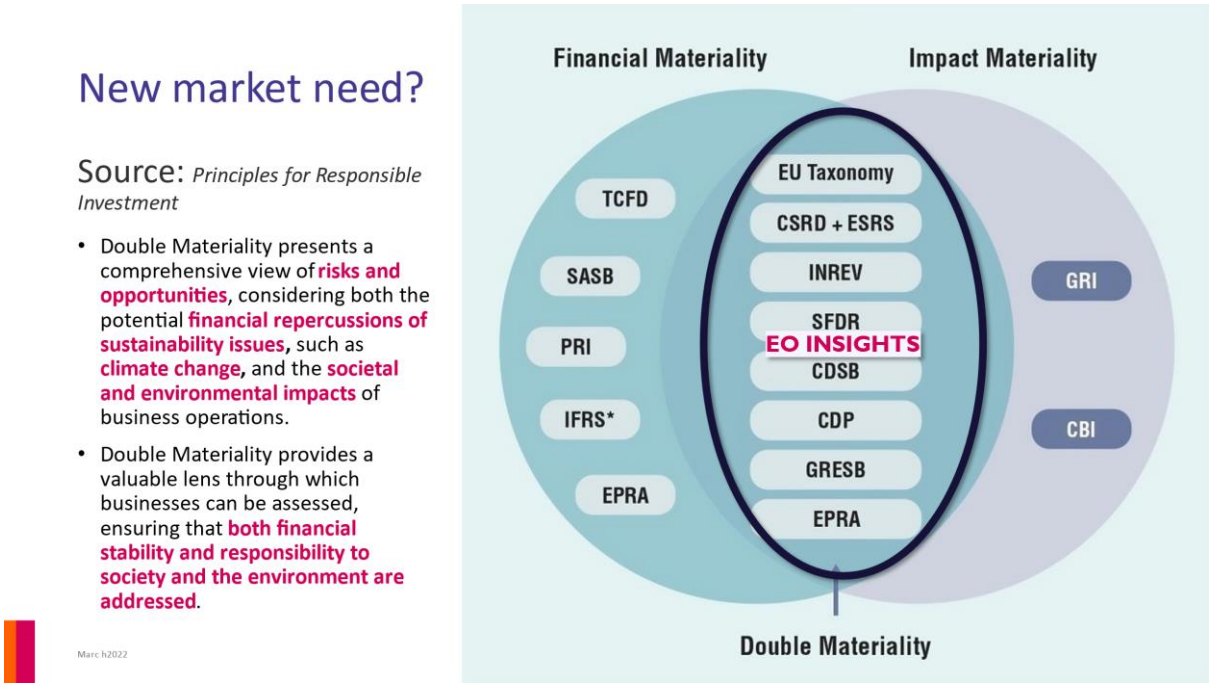
scope or as suppliers or service providers to in-scope organisations) to prepare before the beginning of the first reporting period.

Monetary penalties may potentially be imposed as part of civil sanctions where organisations are in breach.

1.3 Mapping the landscape

The financial sector is desperately trying to understand how it can meet all the new frameworks and reporting requirements. Several organisations have tried to map these. A selection is below.

1.3.1 Principles for Responsible Investment



1.3.2 International Sustainability Standards Board

The global International Sustainability Standards Board (ISSB) standards on sustainability (S1) and climate (S2) will accelerate regulatory efforts on sustainability, provide a common framework for reporting, and improve the usability and transparency of sustainability disclosures.

ISSB published its first 2 new standards on 26 June 2023. They are:

- IFRS S1: General Requirements for Disclosure of Sustainability-related Financial Information
- IFRS S2: Climate-related Disclosures

Both S1 and S2 fully incorporate the TCFD recommendations and have considered feedback from over 1000 consultation responses.

1.3.3 International Finance Corporation (IFC) timeline and ESG mapping

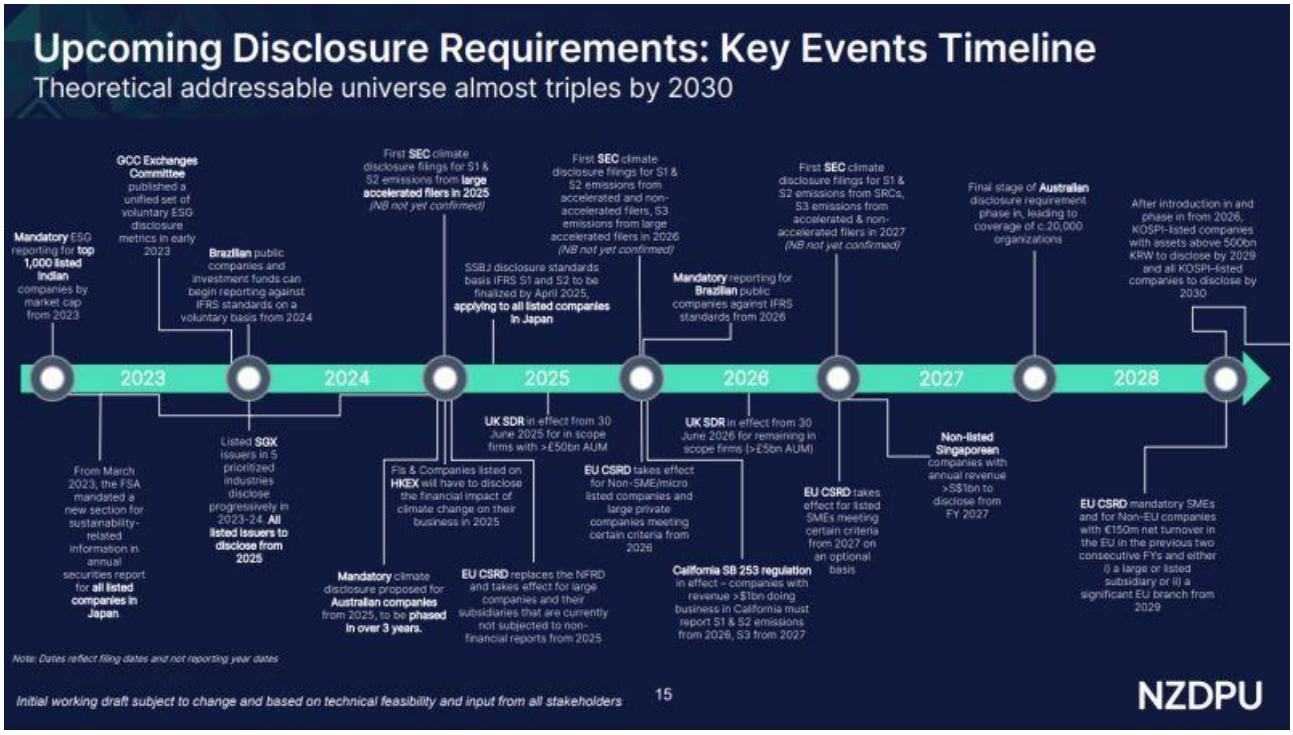
Other regulations:

	EFRAG (expected to be finalised by end June 2023)	ISSB (expected to be finalised by end June 2023)	US SEC (to be finalised)
Enforceability	Standards are developed by EFRAG and regulated by CSRD	Standards are subjected to jurisdictional adoption	Authoritative regulatory disclosure requirements proposed by US SEC
Scope	Broad range of listed and private EU companies or groups, and non-EU companies or groups with significant operations in the EU	Subject to jurisdictional adoption	Nearly all US SEC registrants, including foreign private issuers
Topics in scope	Proposed standards span a broad list of environmental, social and governance topics, including one dedicated to climate disclosures	Proposed standards address climate and other sustainability risks; Additional thematic standards are expected in the future	Proposed rule addresses climate-related risks; A rule addressing human capital is expected in the future
Industry -specific disclosures	Sector-specific standards are in development	Industry-based climate metrics based on the SASB's Standards would be required*	Industry-specific disclosures are not required
Materiality	Multi-stakeholder focused (based on double materiality)	Investor focused	Investor focused - a one percent bright-line threshold would be applied for financial statement footnote quantitative disclosures
GHG emissions reporting	Scope 1, 2 and 3 are required	Scope 1, 2 and 3 are required	Scope 1 and 2 are required. Scope 3 is required if material or included in the registrant's reduction target/ goal (smaller reporting companies exempted)
Location of information	Disclosure would be included within a dedicated section of the management report	Disclosure would be included as part of general purpose financial reporting – such as in management commentary, but with flexibility on location	Disclosure would be included in a separate section of the annual report or registration statement - a financial statement footnote would include disclosure of the impact of severe weather and transition-related activities
Assurance	Sustainability information would initially be subject to limited assurance, transitioning to reasonable assurance at an unspecified date	Sustainability information would be subject to assurance based on the rules of the jurisdictions adopting the standards	Scope 1 and 2 GHG emissions (subject to limited assurance, followed by reasonable assurance); Footnote disclosure (subject to assurance through the financial statement audit and internal control over financial reporting attestation requirements)
Timing of application	Timing would be phased by type of entity starting from 2024 (filing in 2025)	Timing will depend on how standards are implemented in each jurisdiction	Timing would be phased by type of filer

Upcoming disclosure requirement in EU / UK / USA / Japan / India / Brazil / California / Singapore / Australia-

source Net-Zero Data Public Utility (NZDPU)

Net-Zero Data Public Utility (NZDPU): Requirements that might be coming into effect that we need to be aware of for the market.



Security Exchanges Commission (US) update as of 06/03/23

Disclosures required outside of the financial statements include:

- For large, accelerated filers and accelerated filers, material Scope 1 and Scope 2 GHG emissions, subject to assurance requirements that will be phased in.
- Governance and oversight of material climate-related risks.
- The material impact of climate risks on the company's strategy, business model, and outlook.
- Risk management processes for material climate-related risks.
- Material climate targets and goals.

In the footnotes to the financial statements, registrants must disclose financial statement impacts and material impacts on their financial estimates and assumptions due to severe weather events and other natural conditions. Companies will also need to disclose a roll forward of carbon offsets and renewable energy credits or certificates (RECs) in the notes to the financial statements if carbon offsets and RECs are a material component of meeting their climate-related targets and goals.

Source Deloitte [Heads Up — Executive Summary of the SEC's Landmark Climate Disclosure Rule (March 6, 2024) | DART – Deloitte Accounting Research Tool]

Severe weather and other natural condition financial statement impacts	• The aggregate expenditures incurred and losses recognized in the income statement as a result of severe weather events and other natural conditions (e.g., hurricanes, tornadoes, flooding, sea level rise) subject to a threshold of the greater of 1 percent of the absolute value of pretax income (loss) or $100,000. • The aggregate capitalized costs and charges recognized on the balance sheet because of severe weather events and other natural conditions subject to a threshold of the greater of 1 percent of the absolute value of stockholders' equity or deficit or $500,000. • Registrants must determine the aggregate amounts in the bullets above before consideration of any recoveries such as insurance, which would be disclosed separately, and also must disclose the amounts recognized in each financial statement line item affected. • Registrants are not required to attribute the cause of severe weather events or other natural conditions to climate change; instead, they must include the entire amount of the expenditures, losses, capitalized costs, charges, or recoveries in the disclosure when they determine that the severe weather event or other natural condition was a significant contributing factor in recognizing such amounts.
Carbon offset and renewable energy credit (REC) information	If carbon offsets and RECs are material to the registrant's plan to achieve disclosed climate-related targets or goals (e.g., net-zero commitment), registrants must disclose a rollforward of the beginning and ending balances, with separate disclosure of the aggregate amount expensed, the aggregate amount capitalized, and the aggregate amount of losses incurred related to such instruments during the year. Registrants must also disclose which financial statement line items are affected and the accounting policy for such instruments.
Estimates and assumptions	Whether and, if so, how severe weather events and other natural conditions and disclosed climate-related targets or transition plans materially affected estimates and assumptions reflected in the financial statements.

Annex 3 – Data Models for Project Use Cases

REDACTED