D1.1 WORKSHOP#1 REPORT

EO-FIN

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1 EXECUTIVE SUMMARY

The EO-FIN project seeks to understand how, and under what conditions, the Financial Management sector can best benefit from geospatial data, including satellite-derived Earth Observation (EO). This involves identifying geoinformation user requirements for the Financial Management industry, understanding the geospatial capabilities required to meet these needs, and assessing the gaps that exist between requirements and technical feasibility.

The workshop was held as part of the first Work Package, **WP100**, and aimed to gather geoinformation needs, and priorities of the finance sector, explore the perceived barriers to using geoinformation and identify stakeholders to engage with during future phases of the project.

Many individuals showed interest in the workshop, and a total of 49 participated in the workshops on Investment Management and Green Finance, while 31 participated in the workshop on Risk Analysis and Insurance Management. While there are legal, regulatory, and internal guidance concerns that constrain the participation of some finance professionals in workshops of this type, many expressed an interest in the project and have agreed to follow-up interviews. These interviews will allow us to further engage with priority stakeholders and gain an understanding of their viewpoints in a more confidential setting.

In terms of the sectoral composition of individuals who signed up, around a third work in the finance sector, and the remaining 70% were evenly distributed across consulting, research, NGOs and governmental organisations, and organisations that supply the geoinformation to the finance sector. There was a wide geographical distribution of attendees, with 24 different countries represented among workshop signups, of which 13 are ESA Member States or states that fully participate in the programmes of the ESA Education Office. Two-thirds of all participants came from these ESA-aligned states, with most coming from the UK (22%) and Spain (13%).

The workshop was designed to be interactive and to facilitate discussion and yielded several interesting findings relating to the current uses, barriers and enablers of spatial data, and key areas in which participants believe spatial data could provide the most value in the finance sector.

Key findings from the workshop include:

- Many participants' organisations use (28%) or are considering incorporating (47%) geospatial data into their Financial Management decisions.
- One of the main barriers to using spatial data in the four Financial Management domains is a lack of awareness, understanding, and technical knowledge of the workforce in this field.
- Regulation and reporting requirements (or lack thereof at present) were also thought to be key blockers of geospatial data use across multiple domains.

- Promising uses of spatial data include monitoring portfolio assets for Investment Management, identifying physical risk to assets in Risk Analysis, and for parametric insurance products in Insurance Management.
- Participants across all domains felt that spatial data had exciting possibilities in the areas of sustainability and climate, including areas such as ESG investing, climate stress testing, and monitoring and verification of green finance recipients.

1.1.1 Reference Documents

Ref.	Document ID.	Title	Rev.
[RD1]		Proposal: EO-FIN best practice financial management support	
[RD2]		The project management plan	
[RD3]	D1.1	EO-FIN-Workshop-1 report	
[RD4]	D1.2	EO-FIN- Geoinformation requirements report (draft)	

1.2 Acronyms

Tag	Description
COP	United Nations Climate Change Conference
EARSC	European Association of Remote Sensing Companies
EO	Earth Observation
ESA	European Space Agency
GHG	Greenhouse Gas
MRV	Monitoring, reporting, verification
NGO	Non-Government Organisation
UK	United Kingdom
USA	United States of America

2 INTRODUCTION

EO-FIN, an ESA project seeking to understand how, and under what conditions, the Financial Management sector can best benefit from geospatial data. This geospatial data, referred to more generally as 'geoinformation', includes satellite-derived Earth Observation (EO). As part of developing this understanding, the project seeks to identify Financial Management industry user requirements for geoinformation, understand associated EO capabilities that can (potentially) meet these requirements, and assess the gaps that exist between requirements and technical feasibility.

EO-FIN's first Work Package, **WP100**, entails the gathering of detailed geoinformation requirements for business processes. This information is an essential input into the process described above and will be gathered via desk-based research, a workshop to gather user requirements, and semi-structured follow-up interviews with key industry stakeholders.

Box 1 Key terminology

Earth Observation (EO): the gathering of information about the planet's physical, chemical, and biological systems via remote sensing's data and processing of this data

Geospatial data / geoinformation: information about where observations are in relation to one another – any data tagged with a geographic reference is (geo)spatial data. Insights obtained from the analysis of spatial data are referred to as 'geoinformation'.

Spatial Finance: the integration of geospatial data and analysis into financial theory and practice

This report, **D1.1**, represents a formal deliverable summarising the findings of the Workshop held over two days on Thursday February 16th and Friday February 17th, 2023. Specifically, these workshops had three principal aims:

- Gather geoinformation needs, requirements, and priorities within four defined domains within the Financial Management sector:
  - Investment Management: *services including asset allocation, stock allocation, monitoring of existing investments, and portfolio strategy and implementation.*
  - Green Finance: *financial activities that mitigate negative impacts that arise from environmental pollution and climate change, and support development of a greener future.*
  - Risk Analysis: *the process of identifying, assessing, and managing financial, legal, strategic, and security risks to an organisation's capital, operations, and earnings.*
  - Insurance Management: *services including the provision of insurance contracts, underwriting, ongoing and post-event asset evaluation, and claims against insurance policies.*
- Explore the perceived barriers to the wider use of geoinformation within these four domains.
- Disseminate knowledge of the ongoing wider project to assist in the identification and encouragement of interested stakeholders to engage with the other project phases.

3 ATTENDEES

3.1 Total attendance

Excluding attendees from GMV, London Economics, and ESA, a total of 91 individuals signed up for the online workshop, generating a database of names, organisations, and contact details that can be leveraged throughout the project. In the participant statistics that are reported throughout this section individuals from the same three organisations are removed throughout.

A total of 63 unique attendees joined the workshops over the two days, with 17 of these joining for both sessions. Thursday 16th February's workshop was slightly more popular, with 49 attendees to Friday 17th February's 31 attendees. In addition to those attending the workshop, a further four expressed their regret over not being to attend due to prohibitively large time zone differences or clashes with other engagements. These individuals were sent the presented workshop materials and will be contacted for further engagement if deemed suitable by the research team.

Table 1. Descriptions of those who signed-up on two days of workshops.

Total # of sign-ups (excluding GMV; LE and ESA)	91
Unique attendees	63
Attendee joining both days	17
Attendees on Thursday (Green Finance; Investment Management)	49
Attendees on Friday (Insurance; Risk Management)	31
Countries represented	24
EU27 countries	10

Attendance by finance professionals is likely to have been constrained by a number of legal, regulatory, or internal guidance concerns. One would-be attendee expressed their inability to join "these types" of sessions due to their role in "a highly regulated part of the bank [where] MiFID II rules apply". During one of the sessions, one person commented that she was not at liberty to answering a specific question on the granularity of the geoinformation needed/used. Indeed, any professionals in public-facing roles where buy and sell recommendations are made on listed companies are severely constrained in terms of what they can express in public forums such as the workshop. Furthermore, publicly listed organisations are limited in the information they can release to the market about their own organisation, restricting their engagement with the workshop sessions. Elsewhere, some attendees voiced concerns over contributing to the public forum and expressed feeling like it was "a one-way information street".
It was precisely to overcome these hurdles to the greatest extent possible that the contracted team added follow-on interviews and questionnaires where appropriate into the proposal to explore the perspectives of these individuals. We remain confident that stakeholders will be more forthcoming, to the extent that they can be, in these alternate settings.

3.2 Sectoral alignment

Those that signed up for the event came from a diverse range of backgrounds. While every effort was made to target the event's promotional materials at relevant Financial Management professionals that are aligned to the four defined domains, among the attendees there were individuals such as consultants within the EO services industry and academics with an understanding of the relevant markets.

When asked which of the four domains they felt their role or organisation most aligned with, those signing up for the event answered as shown in Figure 1, Evidently, Green Finance and Risk Analysis dominated, with over half of respondents selecting each of these domains.

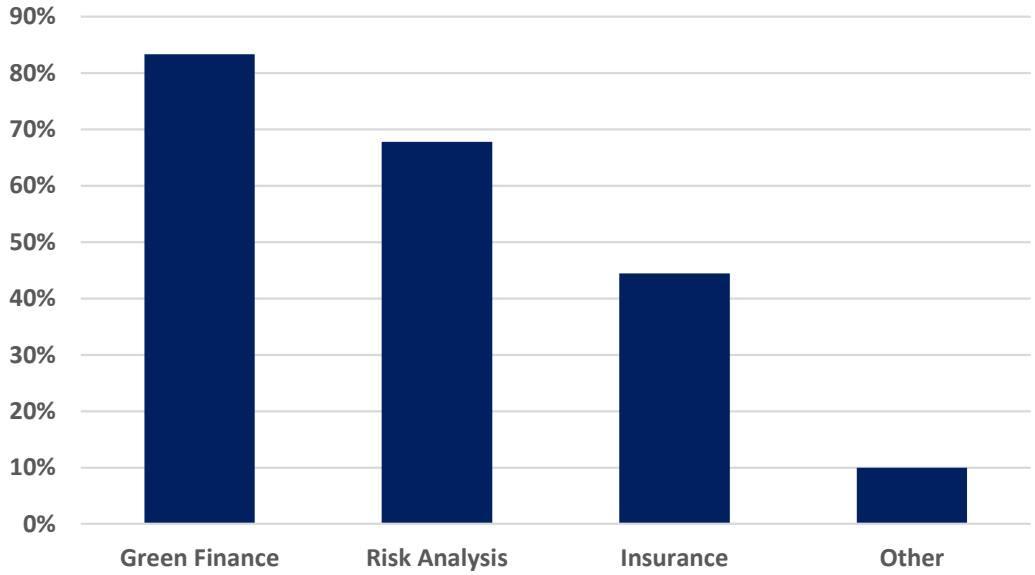


Figure 1. Self-identified alignment of individuals to Financial Management domains.

Note: due to a technical error, responses to the category for 'Investment Management' were not captured. Also note that respondents could select more than one answer, so the reported figures do not necessarily sum to 100%.

A rapid review of self-reported organisations and roles within them was conducted before the event, in order to tailor content presented and questions asked to the knowledge and understanding of those attending. This process also generated a coarse categorisation of those signing up into six main categories:

- Finance – professionals in the Financial Management sector, often specifically within one of the four defined domains.
- Consulting – consultants to or within the Financial Management sector, often working to find and close gaps between demand and supply, or otherwise facilitate the development and deployment of geoinformation products within finance.
- Research – individuals from public and private research institutions with either an academic or professional interest in the use of geoinformation within finance, including journalism.
- Institutional – governmental, NGO, and regulatory organisations who play an important role as potential clients, funders, and rule-setters in the sector.

- Supply-side – developers of upstream or downstream portions of services built on geoinformation that cater to the Financial Management sector.

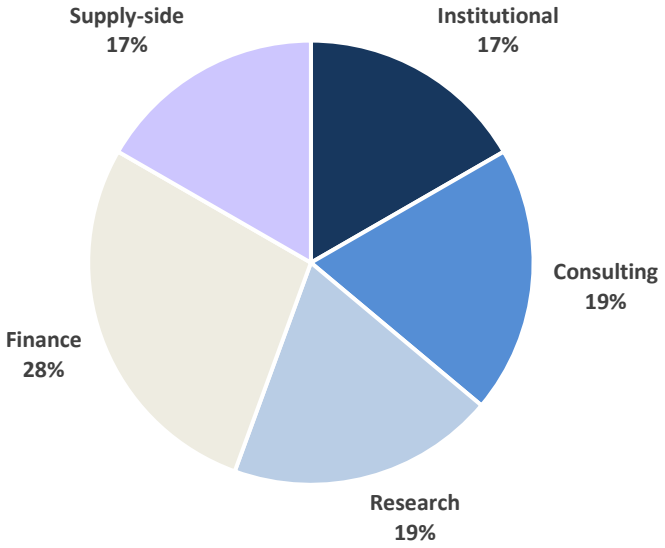


Figure 2. Categorisation of event sign-ups.

Note: These categorisations were constructed and allocated by London Economics analysts.

3.3 Geographical location

There was a wide geographical distribution of attendees, with 24 different countries represented among workshop signups. Of these, the United Kingdom (22%), the USA (18%), and Spain (13%) cumulatively contributing over 50% of attendees.

This pattern is most likely explained by two factors: personal networks and geographical involvement in spatial finance. First, many stakeholders were reached directly via the existing professional networks of the teams from London Economics and GMV, which are based in the UK, US and Spain respectively. Secondly, the USA's distinct lead in private-sector investment and entrepreneurship in the earth observation space[1], and by extension the nascent spatial finance industry, meaning that it is within the expectation that many interested parties would be based there.

Among the EU27 countries, 10 were represented and contributed 39% of all attendees (26% excluding Spain). Among these, Spain, Belgium, and France were the most heavily represented. Representatives from African, South American, Australasian, Caribbean, and Southeast Asian nations also attended the workshop despite time zone differences, ensuring a broad sample of demands and viewpoints were captured.

[1] *"the total volume of investment lags far behind private investment in the US"* in European Investment Bank. (2019). 'The future of the European space sector'

3.4 Motivation for attending

Turning to the attendee's self-stated reasons for signing up for the workshops, a common theme was an interest in developing their understanding of the interaction between 'spatial data' and finance. The reasons for this interest were diverse, ranging from job relevance, academic interest, or personal engagement. Three typical quotes from attendees are reproduced below.

"I have been working in the Insurance and Risk Management segment with a focus on emerging markets for [a long time]. It is time that we leverage technology to support sustainable and resilient finance and Risk Management practices in these markets and globally."

"My work involves assessing companies' environmental footprints and the risks they are exposed to, including through their supply chains. I am interested in the role spatial data can play in this."

"Earth Observation is part of my work portfolio as a Research & Partnerships Manager. I am looking for opportunities and potential partners in the transitioning of usual economics to new ones."

Data from the workshop sign-up questionnaire[2] is presented in the word cloud below. The prominent features of 'earth observation', 'EO', 'spatial', and 'data' highlight people's interest in the technical aspects of the workshop. 'Finance', 'financial', 'risk', 'trading', and 'services' highlight the financial aspect of the attendee's interest.

Figure 3. Word cloud: self-reported attendee reasons for interest in the workshop.

[2] Responses were to the question 'Why are you interested in becoming a stakeholder?'

Source: Workshop sign-up questionnaire. Generated using Jason Davies' generator (https://www.jasondavies.com/wordcloud/)

4 METHODOLOGY OVERVIEW

The WP100 workshop, the first of multiple that are scheduled within the EO-FIN project, was held over two days on February 16th (Investment Management and Green Finance) and February 17th (Risk Analysis, Insurance Management). Agendas for each day of the workshop can be found in Appendix 1. The event was held virtually to remove limits and cost barriers to participation and was timed such that participants from both the United States and EU could simultaneously join at a convenient time of day. Attendees were reached in a number of ways:

- Direct approaches
  - Contacts in relevant roles and organisations who were known from the professional networks of London Economics and GMV were approached with invites, an event flyer, and more information.
  - Letter of Intent organisations, who had pre-registered interest in the project at the proposal stage, were informed of the event and directed to register their interest.
  - Social media contacting – the project team developed a list of relevant/target financial institutions and locate each organisation's LinkedIn profile. Employees were be screened by keyword, for example "green bonds", "risk management", "ESG data", and relative seniority/length of tenure. This approach yielded a highly targeted set of people to approach.
- Indirect approaches
  - Social media channels of ESA, London Economics, and GMV were each utilised to further publicise the event.
  - A special promotional edition[3] of the London Economics *Space in Focus* blog series on spatial finance was produced in the run-up to the event to reach further potential attendees.

A rapid review of self-reported organisations and roles within them was conducted before the event, in order to tailor content presented and questions asked to the knowledge and understanding of those attending.

Each session featured poll questions, giving attendees a chance to provide immediate inputs in terms of their familiarity with topics and to state their beliefs around opportunities and blockers to the use of geoinformation within financial management. The results of these polls are shared throughout this report. These polls were followed by a semi-structured breakout room session in smaller groups, where open discussion of key points was encouraged by moderators from London Economics and GMV. To preserve anonymity, quotes from these discussions in breakout rooms and identities of those answering polls are not attributed to specific individuals or organisations.

3 London Economics. (2023). 'Spatial data for financial management'

5 WORKSHOP FINDINGS

In the first part of the workshop on Thursday 16th we asked attendees to rate their current knowledge of the use of spatial data in Financial Management, and their responses are summarised in the chart below.
A majority, more than 60% of respondents, rated their knowledge as between 'ok' and 'very good'. As the sessions continued, it became evident that the group was relatively well-informed of topics relevant to the workshop and project. The findings from each session are discussed in more detail in the remainder of this chapter.

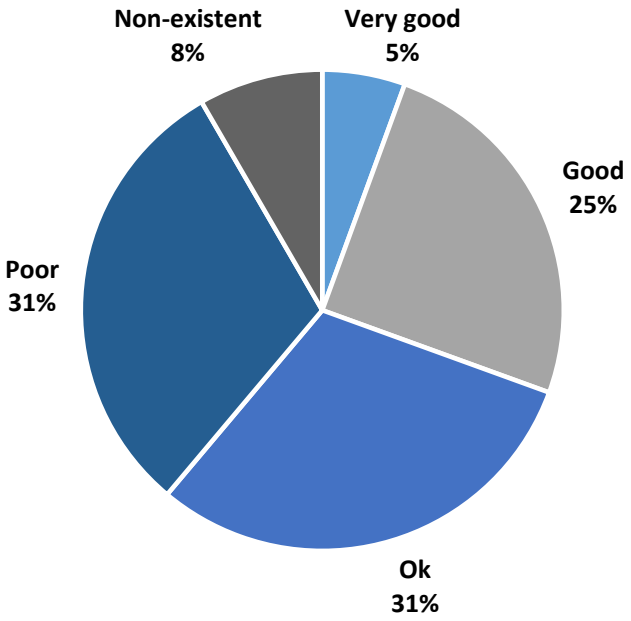


Figure 4. How would you describe your current knowledge of the use of spatial data in Financial Management?

Note: 36 total responses were recorded.

5.1 Investment Management

Throughout the guided discussions in breakout rooms, participants generated a complex and nuanced picture of the demand landscape for geoinformation within the Investment Management sector. To preserve anonymity, quotes and polls are not attributed to specific sources. An overall summary of the discussion points (and their frequency) is provided by a word cloud below.

For the purposes of this study Investment Management services are defined relatively broadly. The industry is highly diversified, with a focus on the allocation of client capital across a wide range of asset classes and investment strategies. This capital is entrusted to investment managers who invest on a client's behalf to deliver a return on their client's capital, mitigate risk, or to deploy that capital in line with particular principles/ethical frameworks. Increasingly common are constraints which take into account environmental,

social, or governance (ESG) considerations, which may be accompanied by associated due diligence and reporting requirements.

While these considerations take different forms across firms and investment strategies, their execution in terms of due diligence and reporting increase the operational cost of investment management. Given these cost drivers, as well as increasing regulatory, political, and social pressure for investment managers to respond to ESG issues such as climate change and ethical supply chains, the adoption of new technology may be of critical interest to this competitive industry. Tools such as satellite-based Earth Observation and associated analytics may offer new insights on prospective assets or streamline compliance with certain ethical frameworks. Through enhanced insight, cost savings over other in-situ measurements, or improved timeliness, geoinformation-based insights may enhance an investment manager's product offering.

Figure 5. Word cloud: Investment Management workshop session.

Source: Workshop notes.

In Investment Management, geoinformation is already used in the following (non-exhaustive) ways:

- **Analysing market signals** – retail signals can be observed through geoinformation. Sudden changes in stock levels to supply chains can provide immediate information about imminent market changes.
- **Tracking global economic trends –** using historical data, geoinformation can be used to monitor major trends in national and international economic activity, including trade flows, night lights, spectrum density and other proxies for economic activity.

- **Monitoring opaque markets** – geoinformation can be used to bridge gaps in formation and address activity in opaque markets, as well as markets that are difficult to monitor because they are remote/very large.
- **Performing due diligence and monitoring existing assets –** monitoring assets, conducting due diligence for stock selection, ensuring compliance, and assessing risks including ESG.

In discussions throughout the workshop, most participants agreed that the most exciting opportunities for spatial data within Investment Management are within the ESG space, and within this space primarily for environmental factors (rather than social or governance factors). Some participants highlighted more niche applications. For example, a participant highlighted that in the agricultural sector socio-economic monitoring was an important factor and here satellite applications offered exciting possibilities.

Participants tended to view the integration of geoinformation as an emerging area rather than one where they were already making progress. They felt that geoinformation offered ample opportunity to improve their current processes and approaches. This is reflected in current usage rates of geoinformation in the investment management space: 28% of participants represented organisations that either /currently use / has considered / are considering/ integrating geoinformation to support their Investment Management activities.

When asked about which geoinformation use case would be most useful to their organisation, an overwhelming majority (74%) of respondents selected '**observing portfolio assets**'. Examples of this that participants highlighted as in-demand in the Investment Management sector include credit scoring in the agriculture sector by monitoring the productivity of fields, risk-screening by geo-mapping clients, monitoring carbon-insensitivity of portfolio assets, evaluating the ESG performance of companies, and the use of geoinformation as proof of due diligence.

The next most popular choices for useful applications of Earth Observation data were '**tracking macroeconomic trends'** (15%) and '**analysing market signals'** (7%). The selection of 'observing portfolio assets' over and above the other two perhaps indicates demand for a more generalised service: the less popular choices represent more highly specified use cases.

One respondent noted that there is a "general lack of understanding in the finance industry regarding spatial data, which is a challenge for Investment Management professionals seeking to integrate new data sources into their decision-making process". On this point, another respondent suggested that data sources are currently presented in an overly technical way and would benefit from being explained to Investment Management professionals in simpler terms. Other participants mentioned that whilst there is a growing awareness within the Financial Management sector of the applicability of geoinformation to existing business practices, it is not always used in the right way. Legal issues and reluctance to share relevant data were also mentioned, although one participant noted that for the vast majority of applications, there are "no legal restrictions on using EO data as long as it does not invade someone's privacy directly".

Multiple participants commented on the fact that many organisations ultimately "work with the data that is available" if it provides value, even if it is imperfect. There was also mention of a need for an independent organisation to confirm the trustworthiness of data, giving it sufficient power to provide verification and validation. This issue appeared to be a significant blocker to the demand for geoinformation being expressed in the market today. Only 3% of respondents believed that 'most Investment Management firms incorporate geoinformation in their models', with the majority (40% and 33%) believing that either 'some' or 'outlier' Investment Management firms incorporate geoinformation in their modelling.

Another point of discussion was the need for 'data-agnostic' products which don't require a client-side understanding of the technical aspects of the data underpinning the service. Such a product, it was argued, would mean that financial investors can more easily implement geoinformation into their analyses. There was widespread support for the value of an off-the-shelf product that financial investors can implement into analyses they are already undertaking immediately and easily. Likewise, in other session, participants highlighted the need for ready-to-use data. The group noted the need for an intermediate layer of service providers to process the raw geoinformation into these off-the-shelf products for the Financial Management sector. This layer/market is currently missing in accordance to the respondents.

When asked what level of granularity is sufficient in the spatial data, participants noted that granularity needs will vary depending on the organisation, and the application of the data, although there was mention of benefitting from improved granularity. One participant noted that the important question is "how the accuracy of EO data can be evaluated in order to make well-informed decisions".

When asked whether assessing investments more frequently is worth paying a premium for, participants noted that this depends on the requirements of the investment, for example, it isn't necessary to get very frequent temperature updates when looking at agricultural investments. One participant noted that most cases would benefit from annual reports, but this is highly variable. Another respondent believed that it would be worth paying a premium for, providing the "process is fast and efficient".

There were discussions regarding the trustworthiness of the data and the intentions of corporations. One participant noted that companies may not want their ESG reports evaluated "in a more transparent way", which is a major challenge for the (voluntary) wider adoption of geoinformation within the Financial Management sector.

5.2 Green Finance

Following the Investment Management session, the Green Finance workshop session allowed attendees to directly focus their attention on how geoinformation can be utilised to improve the use of financial sector products to power the green transition. Their feedback reveals a strong belief in the potential value of such information, but in practice lacks implementation. To preserve anonymity, quotes and polls are not attributed to specific sources. An overall summary of the discussion points (and their frequency) is provided by a word cloud below.

Figure 6. Word cloud: Green Finance workshop session.

Source: Workshop notes

For the purposes of this study green finance includes structured financial activities, products, or services, that have been created to mitigate negative impacts that arise from environmental pollution and climate change. These interventions seek to foster the development of greener business practices, operating models, and a sustainable economy as a whole. These efforts can be divided within two broad categories.

The first category are endeavours which seek to augment current investment management processes and asset classes to improve alignment with environmental objectives. This includes screening for ESG issues as described in the preceding section on financial management. For example, investment managers may exclude certain assets from their potential investment universe based on concerns regarding greenhouse gas (GHG) emissions, environmental degradation, or biodiversity loss. Alternatively, they may explicitly seek out assets which have positive environmental externalities, perhaps through a novel technology or business practice. They may also actively engage with businesses they hold an equity stake in, through mechanisms such as proxy voting. In each of these instances, EO data may offer improved insights, with greater coverage, reduced cost, or improved timeliness to support decision making.

The second category includes those organisations developing novel financial instruments and asset classes to support environmental objectives. It includes an array of debt mechanisms, loans, and investments that are used to encourage the development of green projects or minimize the impact on the climate of more regular projects[4]. One example of this are green bonds, which are designated bonds intended to encourage sustainability and support climate-related or other types of special environmental projects. More specifically, green bonds finance projects aimed at energy efficiency, pollution prevention, sustainable agriculture, fishery and forestry, the protection of aquatic and terrestrial ecosystems, clean transportation, clean water, and sustainable water management. They also finance the cultivation of environmentally friendly technologies and the mitigation of climate change[5].

Stakeholders felt that geoinformation may serve as a critical input in assessing specific environmental and climate risks and thus designating projects for green financing. Furthermore, they highlighted that such data may also play a central role in the creation of novel financial markets. For example, establishing carbon offset markets, where organisations are able to buy and sell carbon credits which correspond to an activity/project that sequesters carbon dioxide, requires a clear mechanism for baseline assessment and subsequent verification.

Geoinformation can be used to aid the proliferation and expansion of Green Finance products by increasing trust of the markets by providing information about the environmental and climate impacts of activities financed under specified green criteria, aiding a verifiable, scalable appraisal of businesses, loans, bonds and projects. This monitoring, reporting, and verification (MRV) process supports markets for green products by increasing transparency and thereby the trust of market participants.

The overwhelming majority of participants, 84%, believe that geoinformation can add a lot of value to Green Finance, with only 4% responding that geoinformation can add 'a small amount of value to Green Finance' and a further 8% of responding that this data has 'a very low opportunity to add value to Green Finance'.
This is contrasted by only 36% of respondents currently using, having considered or currently considering incorporating geoinformation to support their Green Finance activities. Sustainable agriculture and reforestation were identified as the key use sectors for geoinformation for Green Finance, particularly for use in crop monitoring in developing nations. The use of geoinformation for carbon monitoring and to assess green credentials was also mentioned.

Paralleling the discussion in the Investment Management workshop session, gaining recognition of the value of geoinformation was seen as the main barrier to using geoinformation for Green Finance. One respondent noted "a lack of recognition among regulators" (and public bodies more generally) of EO data specifically as high-quality enough information for regulation purposes, often resulting in the same organisations requiring ground-based methods for verification. Even outside of regulation, organisations that set

[4] For more information, see the World Economic Forum: https://www.weforum.org/agenda/2020/11/what-is-green-finance/

[5] For more information please see https://www.investopedia.com/terms/g/green-bond.asp and the International Capital Markets Association's "Green Bond Principles," Available at: https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Green-Bonds-Principles-June-2018-270520.pdf

voluntary standards do "not yet recognise EO as a [credible] source" of information on green activities. Other barriers identified were concerns over "greenwashing" and the associated negative publicity. The potential to engage in activities that could be labelled as greenwashing prevents some organisations from participating in Green Finance activities, as these are often poorly monitored and verified. The cost of data onboarding (particularly high-resolution geoinformation, such as Earth Observation data) for monitoring Green Finance assets hinders organisations further. Another barrier mentioned was that "one set of satellite data is not sufficient and needs to be combined with other sources of data" to extract useful information.

In response to a poll question during the workshop, 54% of participants thought that "a lack of technical knowledge or skills' to analyse data was the main barrier to using EO data for Green Finance. Further, 27% of participants thought that the **main barrier was 'a lack of information about potential applications'**. Potential solutions, discussed at length by attendees, largely focused on so-called off-the-shelf 'data-agnostic' solutions that provide useful insights to clients without requiring specific investment in skills or infrastructure – the insights don't require a deep understanding of the data that drives them, hence the label of 'data-agnostic'. 8% of respondents thought that the main barrier was the high cost of obtaining data.

Introducing regulation and more regular reporting requirements to ensure projects are continuously meeting their targets or financing conditions was mentioned as a key area of future interest for using geoinformation within the Green Finance domain, with one respondent mentioning that improved monitoring of outcomes would "increase issuances [of Green Finance financial instruments] from organisations". More generally, one respondent mentioned that there is "still a lot to be done for [geoinformation] in Green Finance to be recognised as a trusted source" of information.

The key blockers emerging from this workshop session are a lack of technical skill to allow organisations to analyse data, and needing data from multiple satellites to have sufficient information for success in Green Finance. However, the respondents also suggested that EO and geoinformation more generally will be important parts of the solution, with one respondent stating that "Green Finance cannot progress without EO."

5.3 Risk Analysis

The risk management session allowed participants to assess the current uses and the potential applications of geoinformation in risk-management processes within the financial sector. The discussions revealed a strong understanding and enthusiasm for the positive impacts of the applications of geoinformation for Risk Analysis. There was, however, a strong focus on the current constraints of using geoinformation for such processes, such as a reliance on ground-truth data which is highly prone to human error, and consumers in the finance industry lacking the in-house expert teams to analyse and use geoinformation in its raw form, such as satellite-derived EO data.

To preserve anonymity, quotes and polls are not attributed to specific sources. An overall summary of the discussion points (and their frequency) is provided by a word cloud below.

Figure 7. Word cloud: Risk Analysis workshop session.

Source: Workshop notes

For the purposes of this study Risk Analysis includes the process of identifying, assessing, and managing financial, legal, strategic and security risks to an organisation's capital, operations, and earnings. Financial institutions typically have a Risk Management function to ensure they identify risks to their operations and manage these risks, in order to mitigate exposure and impact. These functions typically focus on "material risks". Material risks are risks which have the potential to significantly impact the institution financially.

For financial institutions the quantity and quality of data is crucial in all stages of the risk process – from identification over assessment, to quantification. Better data can change whether a risk can be assessed at all, the level of granularity at which it can be assessed (for example property rather than postcode level), the precision with which it can be assessed, and the timeliness of information can also change the quantified risk. Given the advantages of geoinformation in terms of frequency, granularity, and unique insight over traditional data, it provides great promise in the area of risk management. Geoinformation can be utilised within Risk Analysis in the following ways:

- **Quantifying physical risk** - Assessing the materiality of physical risks and quantifying the size of the unmanaged risk.
- **Climate stress testing** – i.e., the assessment of how climate-related risks impact a FI's business across all sectors and geographical locations under stress scenarios. This is now a required exercise for many UK and European banks. Geoinformation can reduce the cost of data collection and improve consistency across financial institutions and over time.
- **Forecasting to manage volatility** - Advance warnings of supply chain developments or disruptions, provided by geoinformation, can be crucial to forecast and mitigate against the worst impacts of volatility.
- **Measuring socio-economic risk** - Emerging applications of high-resolution geoinformation enables tracking socio-economic trends and human-level events such as

political unrest or terrorism events with implications for understanding risks to business continuity and regional risk levels.

Multiple participants in the Risk Analysis workshop session noted that the bulk of insurance sold is against material risk, and so this is the most likely source of demand for future and emerging products. This is supported by the poll result where 75% of respondents believed that using satellite-based EO data to identify physical risks was the option which could generate the most value in the long-term for Risk Management professionals. It may well be the case that stakeholders have a mistaken understanding of the scope of climate stress testing: one participant stated that they did not "see a difference between physical risk measuring and climate stress testing". Despite this assertion, climate stress testing prescribes very specific scenario analysis and quantitative modelling exercises focused on already-owned portfolio assets, with the specifics defined by the relevant regulators. Measuring physical risk is far broader (without prescribed methodologies or modelling approaches), may not be strictly climate-focused, and can be performed before assets are acquired. This example highlights the importance of stakeholder education as part of the process to understand demand for geoinformation-based products and services in the Financial Management sector.

Another option in the same poll, 'managing volatility', was found to be "of less concern" for respondents. This use case for geoinformation was felt to represent a "smaller potential market", and hence less demand existed for such services. Despite the strong focus on the identification of physical risks to assets, attendees did raise biodiversity and nature risk as other potential sources of demand. This may be explained by the increased attention on this area in the policy space. For example, the COP for biodiversity just finished in December and the Taskforce for Nature Related Disclosures is also ramping up. 25% of respondents believed climate stress testing was the most important and none of the respondents polled believed that 'socio-economic risk management' had the potential to generate the most value in managing long term risks. This stance was underscored in the breakout session, where one participant stated that "Socio-economic risk measurement is also of low priority, and it will [only] become relevant [once it impacts assets] on a macroeconomic level".

Participants highlighted that in some regions or situations, there is a growing need to update risk models to take account of more dynamic variables. For example, human-driven geographical change includes both climate change (rising sea levels, warming climate) and urbanisation in the developing world. Each of these changes the risk profile of entire areas over time, and in some areas such as the developing world participants felt that this is of particular interest – "very applicable to exploding urbanization in the developing world". The relevant data could be difficult to obtain from the ground because the data is changing rapidly, or it is impossible to travel to a specific location (e.g., due to political instability, conflict, or remoteness). Satellite-based EO data was specifically identified as a technology that can offer an efficient and accurate way to capture this geoinformation.

It was further pointed out that there are only a few global projects that allow you to assess the vulnerability of asset-specific risks (e.g., floods) at a portfolio level, despite the "obvious value" this generates for Risk Management professionals. This was supported in the polls

where only 20% of respondents stated that they were aware of their organisation incorporating geoinformation in their Risk Analysis processes.

Awareness and understanding of what is possible with geospatial information are key blockers. Some attendees had organisational experience in training institutions to assess portfolio risk and noted that doing this on a global scale generally requires in situ assessments and ground-truths which themselves are "highly" prone to human input errors. One participant stated that this makes assessing the vulnerability of their assets globally very difficult because of the reliance on hard-to-collect ground-truth data. One participant also noted that consumers in the finance industry often lack the in-house expert teams to analyse and use geoinformation data, including EO data from satellites. This was underscored by another participant in the breakout rooms who opined that "[while] regulators in Europe are very ambitious, the data provision is not ready, nor are the teams in the companies".

Also on the point of awareness and understanding, participants further noted that there is a need to be both aware of the technology and to have information on intermediate companies that can actually provide the analysis - "the middle layer [of companies] able to generate ready-to-use data is not well developed". There was a consensus among participants that there are knowledge gaps regarding geoinformation data handling and analysis. Discussions surrounding the reduction in the reliance on ground-truth data, and the development of a "missing market" for such data and its processing were strong indications of potential future demand. This was again supported in the polls where 33% of respondents stated they were not currently using geoinformation but were considering incorporating it in Risk Management processes in the future.

A key distinction was drawn between climate (or 'risk' models) and vulnerability (or 'value at risk' models) – participants believed that these are generally not integrated, meaning the Financial Management sector does not meaningfully integrate climate risk models into their portfolio risk management analyses.

5.4 Insurance Management

The insurance session allowed participants to analyse the potential benefits and constraints of using geoinformation for insurance processes. The discussions highlighted some of the potential advantages of using geoinformation, such as expanding market access to those previously uninsured by providing a higher granularity of data than currently exists, which could allow firms to gain a competitive advantage through product innovation based on this improved data. There were extensive discussions regarding the current constraints of using geoinformation for insurance purposes, with the most significant of these being legislative issues making geoinformation unusable on its own in certain contexts.

Figure 8. Word cloud: Insurance Management workshop session.

Source: Workshop notes

For the purposes of this study the Insurance Management industry is defined as the section of the finance industry that provides risk management solutions in the form of insurance contracts. Insurance contracts serve as a hedge against uncertain or contingent losses to assets or occurrences which may impact business operations. The contract, or insurance policy, details the conditions and circumstances under which the insurer will compensate the policyholder, or their designated beneficiary. The core business functions within the insurance management industry pertain to investment management, actuarial services, underwriting, and claims[6].

Geoinformation can add value across the full range of insurance industry activities. For example, geoinformation can be used in the following ways:

- **Validating self-reports** - Insured assets can often be observed through satellite-based EO-provided geoinformation. Self-reported asset inventories and states can then be validated against remotely captured data on the asset's condition.
- **Assess claims against policies** – pre- and post-claim geoinformation can be used to rapidly assess the extent of insurance pay-out required, enabling a faster, more accurate, and less costly claims process.
- **Parametric insurance products** - Insurance policies that automatically pay out based on measurable events (e.g. storms, earthquakes, crop damage) can be directly supported by geoinformation, and are particularly advantageous in cases where other data is often poor or unavailable, such as rural or less developed (or both) regions.
- **Expanding coverage** - The ability to remotely monitor assets, and hence add value through validation, assessing, and creating new financial products can mean satellite-

6 Hernandez,V. (2020). 'How Satellite Data Is Helping Hedge Funds Outperform.'

provided EO geoinformation allows expansion of coverage to areas previously deemed too remote or unprofitable.

In terms of the demand for geoinformation-based services, all of the use cases mentioned (validating self-reports, assessing claims against policies, parametric insurance products and expanding coverage) were deemed to be valuable in the discussions with workshop participants. One participant stated that for them, "all [of the use cases] and more" would make a big difference for their organisation because of the link between improved information and the pricing of risk by insurers: "the better the data, the more accurate the pricing". When prompted to select the most useful use case for their organisation the majority (71% of respondents) believed that parametric insurance products would be the most useful. The remainder, 29% of respondents, believed that assessing claims against policies represented the best use case for their organisation.

The participants identified several barriers in the discussions. Regulatory issues arising from using EO data for insurance purposes were mentioned, with one participant highlighting that "in the US" it is currently against federal regulation "to incorporate satellite EO for the purpose of crop insurance". It was further noted that geospatial solutions do not fit with regulatory requirements more generally and that therefore many companies maintain protocols and data governance rules that prevent their adoption.

An additional major blocker identified was the lack of provision of customer-ready products. One participant noted that geoinformation is often not being utilized due to its relative "complexity", and that "it is not ready-made for end users". This currently leads to a serious inability to integrate geoinformation with the existing systems and processes insurance companies use, despite "corporations [already having] spent a lot of time, money, and effort to try and understand the usability of EO data".

Several areas of potential growth in demand for geoinformation-based products and services were examined by the participants. There was a discussion regarding the potential use of high-granularity data. In the UK, insurance modelling is reportedly mainly conducted using postcodes, which can cover areas that are not localised enough for assessing the risk posed by many hazards. Properties that are mislabelled as high-risk for flooding based on postcode data can be relabelled more appropriately using high-granularity data (e.g., property on a small hill in a floodplain). This use of high granularity data to better classify property risk allowed the expansion of the market to those previously uninsured. Thus, high-granularity data can give add value to insurance companies and society more broadly, if employed correctly.

Participants also identified as an issue the trapping of the geoinformation and EO data ecosystem in "pilot schemes" as an issue. In effect this means that funding is secured to develop prototypes but this money runs out before the product or service can be scaled to the point of financial sustainability, meaning the impact of the pilot scheme does not persist long-term. In the UK for example, insurance companies operate quite traditionally and take time to change. Therefore, the time element for small to medium pilots doesn't suit their cash flow and they end up running out of money in that time. Moving beyond pilot schemes for EO data providers was identified as an area of great potential.

6 CONCLUSION

The workshop was designed to be interactive and to facilitate discussion. Consequently, several interesting findings relating to the current uses, barriers and enablers of spatial data emerge. Participants also identified key areas in which they believe spatial data could provide the most value in the finance sector.

The reported **use of geospatial data** was highest for individuals working in Risk Analysis, with 47% of participants' organisations currently using or considering incorporating geospatial data. Across the remaining three domains, between 28% - 36% of participants' organisations use or are considering incorporating geospatial data into their activities.

Participants agreed that a lack of awareness, understanding, and technical knowledge are the **main barriers** to using spatial data in the finance sector. Participants in the Risk Analysis workshop mentioned that there was a lack of in-house expert teams in the finance industry and suggested that there is a missing market for geospatial data processing. This was echoed by participants in the Investment Management and Insurance Management workshops, who identified that a lack of customer-ready products, that do not require a technical understanding of the data underpinning the service, as blockers to the adoption of spatial data.

Another key bottleneck to the use of geospatial data is changing the minds of **regulators and standard setters** responsible for the Financial Management sector. In Green Finance it was related that the organisations that set voluntary standards do "not yet recognise EO as a [credible] source" of information on green activities, and regulatory issues were discussed across each of the other domains. In many conversations and polling results across the four domains participants expressed frustration at how this means organisational interest doesn't translate to large enough resource investments in incorporating geoinformation into business processes - often because there is no actual requirement to do so.

Other barriers to using geospatial data include reluctance to share relevant data, concerns around being unintentionally caught up in a greenwashing scandal, the cost of data onboarding, and behaviour change.

Participants from the four sessions differed in their views of the **enablers of geospatial data** in Financial Management. Participants in Green Finance identified regulation and regular reporting as key areas of interest for using geospatial data to aid Green Finance. Participants in the Insurance Management workshop stated that better data would result in more accurate insurance pricing, and high-granularity spatial data could enable growth for them, while Investment Management participants reported that data granularity requirement was highly dependent on the organisation and the use case.

The most **promising uses of spatial data** in the Financial Management sector that emerged during the workshop were to monitor portfolio assets for Investment Management, to identify physical risk to assets in Risk Analysis, verifying promised 'green' activities in agriculture and reforestation projects, and for parametric insurance products in Insurance Management.

Participants across all domains felt that spatial data offered exciting possibilities in the areas of sustainability and climate. Participants in the Investment Management workshop agreed that "environmental" factors were more interesting for spatial data than "social" or "governance" factors. In the Green Finance workshop, almost 90% believe that geospatial data can add value to Green Finance, with 84% saying it could add 'a lot' of value. Participants in the Risk Analysis workshop raised biodiversity and nature risk as potential sources of demand for geospatial data, and 25% of respondents believed climate stress testing was the most important application of spatial data in Risk Analysis.

The feedback collected from the workshop will in turn inform further engagement with stakeholders (both, those stakeholders already engaged and additional ones) through interviews. Finally, we will translate the collected user requirements from Financial Management jargon to technical EO jargon before wider dissemination of the project findings to the public via an EARSC web portal, where stakeholders will be able to see them and provide feedback.

Annex 1 Appendix 1

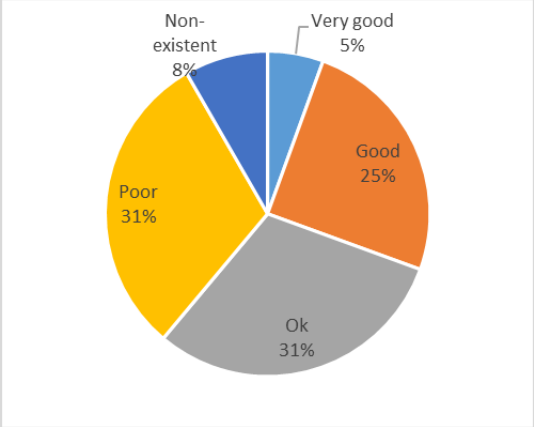
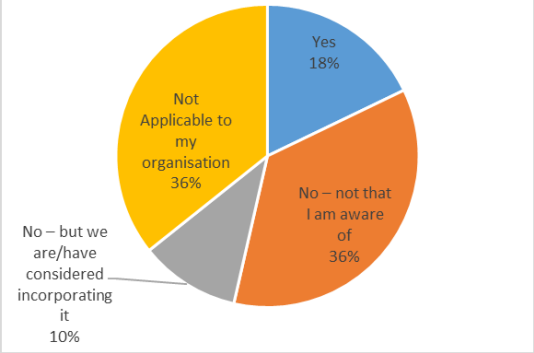
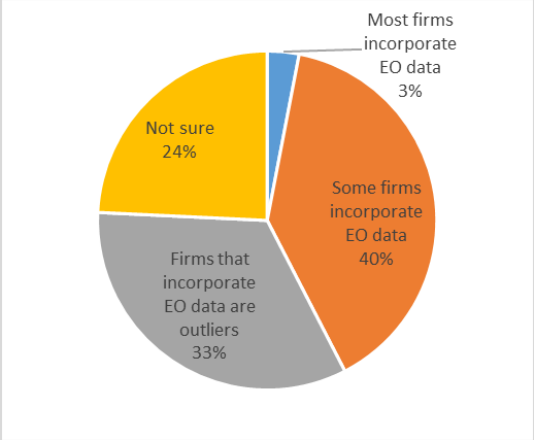
This annex includes the agendas for each of the workshop days and the results of the polls run on both days.

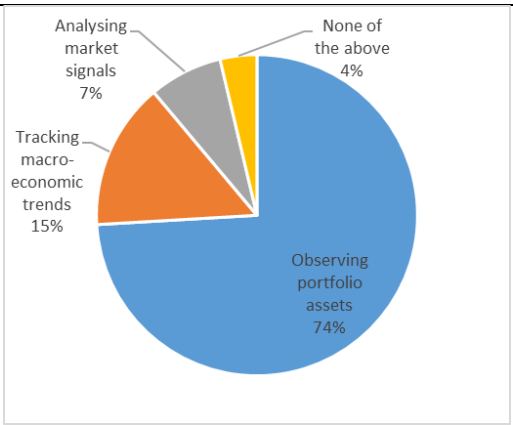
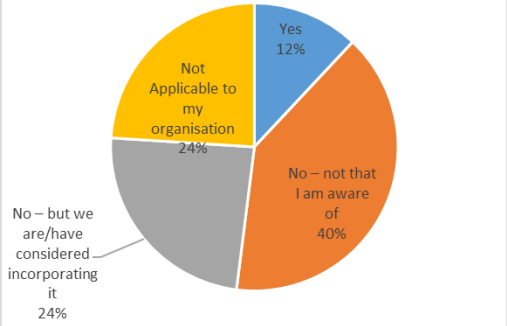
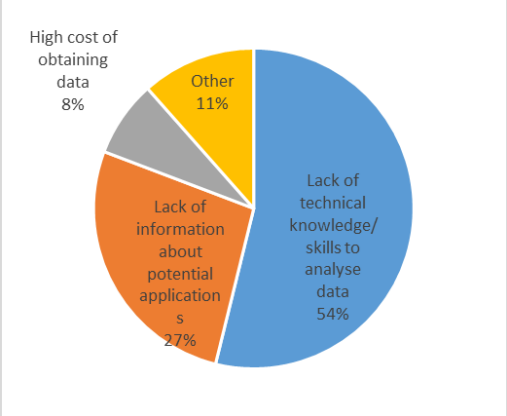
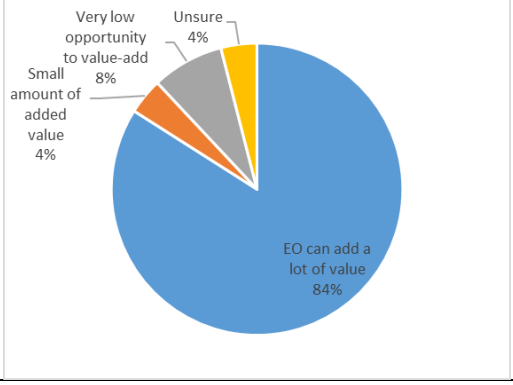
A1.1 Thursday 16th February

Spatial Data for Financial Management Workshop A 16/2/2023 - 14:00-16:00 GMT		
SESSION 1 - Opening		
Time (GMT)	**m**	**Topic**
14:00 - 14:05	5	Welcome and Introduction to project
14:05 - 14:15	10	Project context, summary, and Workshop objective
SESSION 2 - Investment Management		
Time (GMT)	**m**	**Topic**
14:15 - 14:25	10	Presentation of Investment Management topic area, current state of our findings, any points of interest
14:25 - 14:45	20	Guided discussion in breakout rooms
14:45 - 14:55	**10**	**Comfort break**
14:55 - 15:00	5	Session wrap-up with summary across breakout rooms
SESSION 3 - Green Finance		
Time (GMT)	**m**	**Topic**
15:00 - 15:10	10	Presentation of Green Finance topic area, current state of our findings, any points of interest
15:10 - 15:30	20	Guided discussion in breakout rooms
15:30 - 15:40	**10**	**Comfort break**
15:40 - 15:45	5	Session wrap-up with summary across breakout rooms
SESSION 4 - Conclusions		
Time (GMT)	**m**	**Topic**
15:45 - 15:50	5	Session 2 & 3 Wrap-up
15:50 - 16:00	10	Next steps
16:00		**Meeting Close**

A1.1.1 Polls and results

As part of the workshop, attendees were polled on key questions related to geoinformation data usage in the financial sector. This subsection presents the questions and answers provided for the Thursday polls.

Question	Answer breakdown
How would you describe your current knowledge of the use of spatial data in financial management?	
Does your organisation currently use EO data to aid investment management decisions?	
From your perspective, to what extent are investment management firms incorporating EO data in their models?	

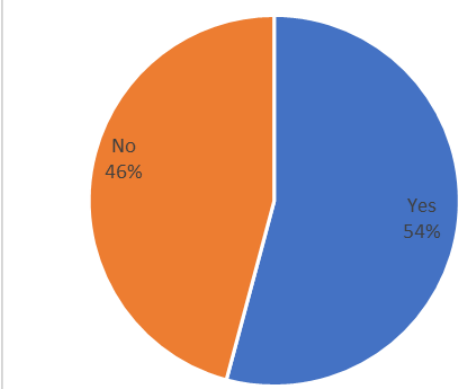
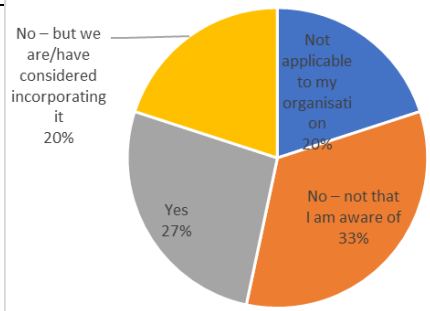
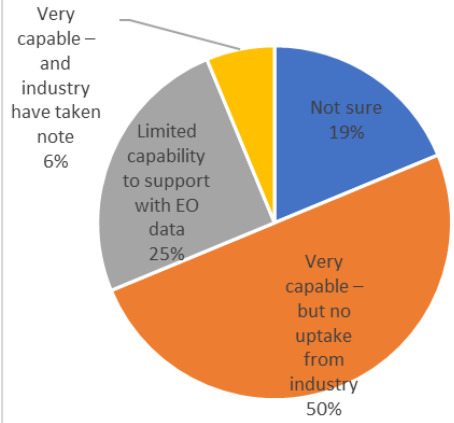
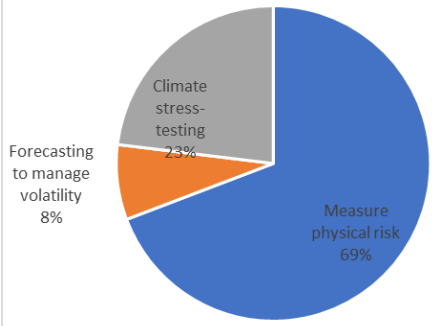
Question	Answer breakdown
Of the four groups of EO data use cases, which do you think could be most useful to your organisation?	
Does your organisation currently use EO data to aid Green Finance decisions?	
What do you see as the main barrier to using EO data for Green Finance?	
To what extent do you believe EO data can add value in Green Finance?	
Please indicate whether you would be interested in engaging further as this project continues	19 positive responses.

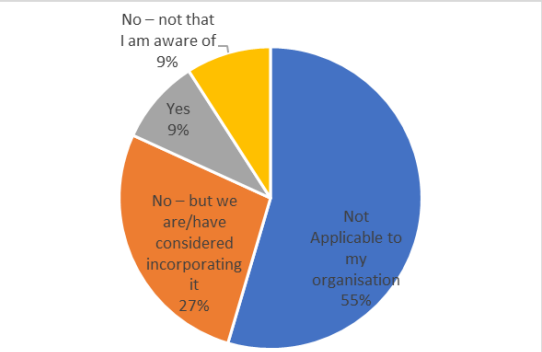
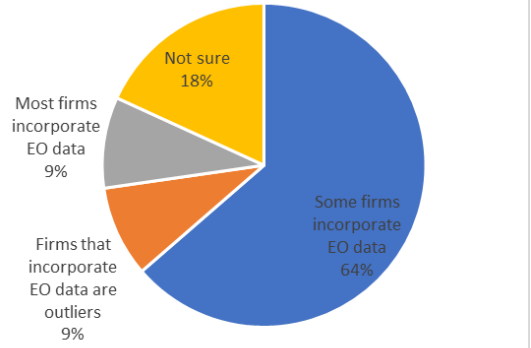
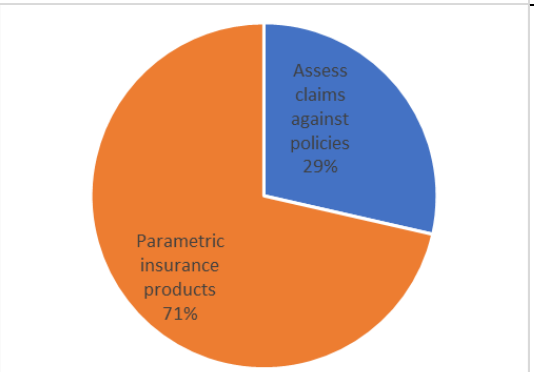
A1.2 Friday 17th February

Spatial Data for Financial Management Workshop B 17/2/2023 - 14:00-16:00 GMT		
SESSION 1 - Opening		
Time (GMT)	**m**	**Topic**
14:00 - 14:05	5	Welcome and Introduction
14:05 - 14:15	10	Project context, summary, and Workshop objectives
SESSION 2 - Risk Management		
Time (GMT)	**m**	**Topic**
14:15 - 14:25	10	Presentation of Risk Management topic area, current state of our findings, any points of interest
14:25 - 14:45	20	Guided discussion in breakout rooms
14:45 - 14:55	**10**	**Comfort break**
14:55 - 15:00	5	Session wrap-up with summary across breakout rooms
SESSION 3 - Insurance		
Time (GMT)	**m**	**Topic**
15:00 - 15:10	10	Presentation of Insurance topic area, current state of our findings, any points of interest
15:10 - 15:30	20	Guided discussion in breakout rooms
15:30 - 15:40	**10**	**Comfort break**
15:40 - 15:45	5	Session wrap-up with summary across breakout rooms
SESSION 4 - Conclusions		
Time (GMT)	**m**	**Topic**
15:45 - 15:50	5	Session 2 & 3 Wrap-up
15:50 - 16:00	10	Next steps
16:00		**Meeting Close**

A1.2.1 Polls and results

This subsection presents the questions and answers provided for the Friday polls.

Question	Answer breakdown
Did you join the workshop yesterday?	
Does your organisation incorporate EO data in your risk management processes?	
From your perspective, to what extent are EO data service providers currently capable of supporting risk management processes?	
Of the four groups of EO data use cases, which do you think could generate the most value in the long-term for risk management professionals?	

Question	Answer breakdown
Does your organisation currently use EO data in its insurance activities?	
From your perspective, to what extent are insurance firms incorporating EO data in their models?	
Of the four presented groups of EO data use cases, which do you think could be most useful to your organisation/firm?	
Please indicate whether you would be interested in engaging further as this project continues	9 positive responses