D3.2 USER FEEDBACK/LESSONS LEARNED REPORT

EO-FIN

Prepared by: GMV (Rahman Momeni, Enes Hisam, Jorge Pacios Martínez)

Approved by: Rahman Momeni

Authorised by: Rahman Momeni

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[RD1]	Proposal	Proposal "EO-FIN Best Practice for Financial Management Support"	
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[RD3]	D1.1	Workshop-1 summary report	1
[RD4]	D1.2	EO-FIN-Geoinformation requirements report (draft)	0.1
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[RD9]	D2.3	EO-FIN-Workshop-2 summary report	
[RD10]	D3.1	EO-FIN-Prototype identification (draft)	0.1
[RD11]	D3.1	EO-FIN-Prototype identification (final)	1

ACRONYMS

Acronym	Definition
AoI	Area of Interest
EARSC	European Association of Remote Sensing Companies
EO	Earth Observation
ESA	European Space Agency
ESG	Environmental, Social, and Governance
FM	Financial Management
GIS	Geographical Information Systems
IT	Information Technology
WP	Work Package

1. INTRODUCTION

Following the development of the Earth Observation (EO) prototype on a multi-natural hazard web platform, this report describes the feedback and findings of lessons learned over the development and improvement of the EO-FIN multi-natural hazard web platform. The report is intended to provide valuable insights into the effectiveness of the EO service and its potential impact on the financial management sector.

The present report aims to address the facilitation of the commercialisation of EO services within the financial management (FM) sector by overcoming existing barriers, identifying the characteristics of ideal EO services, and demonstrating the value of EO-derived solutions. Financial institutions face challenges such as the high cost of EO data, the complexity of IT systems, and a lack of geospatial skills. Overcoming these barriers is critical to harness the full potential of EO services in domains such as risk management, investment analysis, and green finance.

An ideal EO service for the FM sector should offer comprehensive, reliable, and user-friendly access to EO data tailored to financial applications. Such services must provide historical risk data, multi-hazard assessments, and forecasting capabilities in formats accessible to geospatial experts and general users. This report details these characteristics, emphasising the need for integration with existing financial systems, robust data validation processes, and flexible delivery formats.

Demonstrating the value of EO-derived solutions is essential for their adoption in the FM sector. This report presents concrete examples and case studies where EO data has enhanced financial decision-making, improved risk assessments, and provided significant economic benefits. Through targeted training, open communication channels between EO providers and financial users, and iterative service improvements based on user feedback, the commercialisation of EO services can be significantly accelerated, driving innovation and efficiency in the financial management sector.

1.1. PROJECT OVERVIEW

The activity "Best EO practices to support financial management (EO-FIN)" is an ESA-fully funded project aiming to understand the current, and short-term future, EO capabilities that can support the Financial Management (FM) sector. This project studies EO best practices meeting the best responses to the FM sector's needs and requirements. The best EO practices are expected to lead to better products, greater customer trust, and a more competitive position in the market.

1.2. PURPOSE

The goal of this activity can be broken down into the following objectives:

1. Identify and consolidate the geoinformation needs and priorities within the domains of concern: Investment Management, Green Finance, Risk Analysis, and Insurance Management.
2. Identify and characterise EO-based products and services meeting the needs of the domains of concern by assessing the gaps between these and what EO can offer, now and in the near future.
3. Implement and test on a Virtual Platform at least one prototype of an identified EO-based service.
4. Define a roadmap for building EO industry guidelines for the commonly accepted best-practice use of EO-based information by companies within the FM sector.
5. Disseminate the analysis results via key international associations and bodies representing the sector, like EARSC (on the EO side).

1.3. PROJECT BREAKDOWN STRUCTURE

Figure 1 shows the EO-FIN project breakdown structure by describing the entire scope of the EO-FIN project, and the distribution of the work among the three teams that form part of the consortium: GMV-NSL, London Economics, and GMV AD. Overall, there are five WPs defined, namely:

- WP1. Collection of geoinformation requirements and associated constraints (corresponding to Task 1 in the SoW)
- WP2. Definition of current EO capabilities and use (corresponding to Task 2 in the SoW)
- WP3. Development of a service prototype (corresponding to Task 3 in the SoW)
- WP4. Development of a best practice roadmap (corresponding to Task 4 in the SoW)
- WP5. Overall management

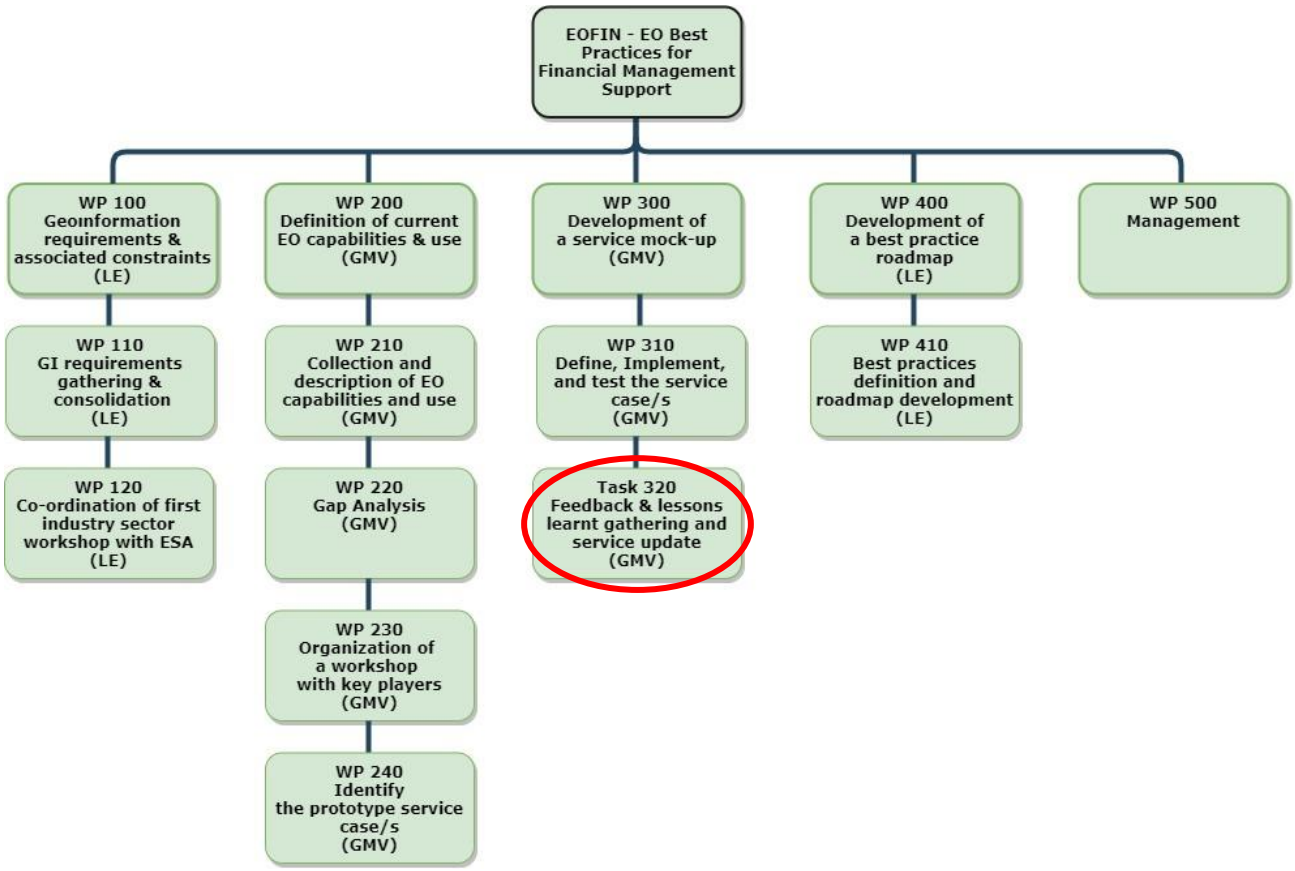

Figure 1. EO-FIN work breakdown structure.

1.4. SCOPE OF THE PRESENT REPORT AND TARGET AUDIENCE

This report aims to provide a comprehensive analysis of the lessons learned during the EO-FIN project, focusing on three primary objectives. First, it includes an assessment from stakeholders of the EO multi-natural hazard service, highlighting the added value, limitations, and additional needs identified through their experiences. This user feedback is crucial in understanding the practical benefits and challenges faced by financial stakeholders when integrating EO services into their operations. Second, the report details the improvements made to the service based on the feedback received from prototype users. These enhancements are designed to address identified limitations and better meet user needs, thereby refining the service for broader commercial applications. Finally, the report concludes the prototype implementation and the collection of user feedback, providing insights into the effectiveness of the EO service, its potential impact on the financial management sector, and recommendations for further development and commercialisation strategies.

2. USER ENGAGEMENT PROCESS

The team effectively engaged with financial users to gather the specifications and properties of optimal EO best service for the FM sector. These efforts aimed to gather comprehensive feedback during both the development phase and after the completion of the EO prototype.

1) Stakeholder board meetings:
   - Routine meetings with stakeholder board members were held to gather insights and feedback during the definition and development of the prototype. The team aimed to incorporate all feedback into the development process. While most feedback was directly applicable to development, additional insights helped to understand financial users' needs and expectations for full-scale commercialisation.

2) Prototype testing with experienced users:
   - After developing the prototype, the team selected two users with significant experience in using geospatial datasets and products on various FM practices.
   - To gather their feedback, the team sent them a comprehensive package that included:
     - A video tutorial demonstrating how the web platform prototype operates, from selecting an Area of Interest (AoI) to downloading EO-derived products.
     - A tutorial handout explaining all features of the EO service.
     - Product sheets with metadata, specifications, and examples of each product.
     - An online questionnaire via Google Forms.

3) Feedback analysis and iteration:
   - After receiving responses from both users, the team analysed the answers and developed a second version of the questionnaire.
   - Responses from both questionnaires were used to gather further feedback during in-person interviews, ensuring a thorough understanding of user experiences and needs.

3. FINDINGS

The overall feedback received on the EO multi-natural hazard web platform service was positive. Users found the EO-FIN web platform service easy to use and interact with, appreciating the ability to select different products and layers within the same interface. The process of ordering, purchasing, and downloading products is straightforward and designed to accommodate users' varying levels of experience, focusing on one decision at a time. However, users also provided feedback aimed at further improving the EO-FIN web platform service for successful commercialisation.

A user remarked on the goal of the EO-FIN web platform prototype:

"I just want EO-FIN to be the platform that has thought about all possible use cases and aggregated that information in the most scientifically robust way, so I feel confident about downloading it and using it as the starting point of my analysis".

This section describes lessons learned during project life and findings in seven sections including barriers, web platform features, wider range of EO-derived products for natural hazard risks, the accuracy of EO-derived products, financial management sector, stakeholder engagement, and commercialisation.

3.1. BARRIERS

Here are high-level barriers that prevent financial institutions from using commercial EO products.

Cost considerations: Cost is one of the key barriers to adopting the EO service in the financial management sector. Generating EO products in particular EO products that are derived from high-resolution and near-real-time data can be expensive. The costs of EO-derived products are not limited to data acquisition but also include expenses related to data processing, integration, and analysis, which can be substantial. Financial institutions may find it challenging to justify the investment required for EO products, especially when the return on investment is not immediately apparent.

Lack of direct communication channels: Effective collaboration between EO service providers and financial management professionals is hindered by the absence of direct communication channels. This lack of direct dialogue leads to a disconnect where EO products may not be tailored to the specific requirements of financial institutions. Financial managers might not be aware of the potential applications and benefits of EO data, while EO providers might not comprehend the financial sector's operational constraints and decision-making processes. One potential reason would be that financial experts often lack the technical knowledge to engage directly with EO specialists. Bridging this gap requires creating platforms or forums where both parties can interact, share insights, and address specific needs.

Lack of geospatial skills in the financial management sector: The financial management sector traditionally relies on economic data, market analysis, and risk assessment models that do not require expertise in geospatial technologies. The introduction of EO products necessitates a new set of technical skills, including data interpretation, spatial analysis, and integration of EO data with existing financial models. Many financial institutions lack the in-house expertise to effectively leverage EO data, creating a significant barrier to adoption. This skills gap requires substantial training and development efforts, which can be both time-consuming and costly.

Complexity of IT systems: Financial institutions operate complex IT systems that are heavily regulated and designed to handle vast amounts of data. Integrating EO data into existing systems can be intricate and time-consuming. Compatibility issues, data formats, regulatory compliance, operational efficiency, and security protocols pose challenges. The complexity of achieving such integration, coupled with the risk of potential disruptions, discourages financial institutions from adopting EO technologies. Collaborative efforts between EO providers, IT experts, and financial managers are essential to streamline integration and ensure seamless data flow.

3.2. WEB PLATFORM FEATURES

Area of Interest (AoI) identification

The users emphasised the importance of the user interface to offer broader features for selecting the Area of Interest (AoI). This improvement aims to facilitate user interaction with the platform and expand the range of use cases. Here is the list of those features:

- Ability to select the AoI as points besides polygons.

- Ability to upload a shapefile (.shp) or "CSV" files of the AoI. Those files shall contain polygons or points of information.
- In the case of the AoI as points, there is a need to add a buffer (the buffer can be fixed or predefined by the user) to cover the actual region of the AoI or the surrounding areas which are important for many applications where monitoring the suspectable risks over the surrounding areas is crucial.

Formats of EO-derived products

To address the diverse needs of users with varying experience levels in geospatial data, it is crucial to offer Earth observation (EO) products in a wider range of formats. Consider the following formats based on user proficiency:

1) TIFF and SHP Formats (Advanced Users):
   - Users with expertise in geospatial data analysis prefer formats like TIFF (Tagged Image File Format) and SHP (Shapefile). These formats allow seamless ingestion into specialised tools for processing and analysis.
2) PDF, CSV, and PNG/JPG Formats (General Users): For FM professionals with limited geospatial knowledge, providing EO products in more accessible formats is essential. Consider offering:
   - PDF: Suitable for easy viewing and sharing of maps and reports.
   - CSV (Comma-Separated Values): High interest among users in exporting data to Excel sheets or extracting information over specific Areas of Interest (AoIs) as points.
   - PNG/JPG: Useful for visual representation and inclusion in presentations.
3) Advantages of the CSV Format: The CSV format is particularly valuable for:
   - Exporting Data: Users can export information from maps directly to Excel sheets for reporting purposes.
   - Point Information: EO data in CSV format provides detailed information on specific points, which is essential for disclosure and decision-making.
   - Asset Boundaries: Some users may require CSV files covering entire asset boundaries, not just point locations. This flexibility accommodates varying use cases.

By diversifying the available formats, FM platforms can better serve their user base, ensuring accessibility and usability across different skill levels.

Metadata:

User feedback highlights the critical role of detailed metadata during the EO product selection process. The metadata and a product sample should be available for the users during the selection of the products. Here are why providing detailed metadata is necessary.

1) Informed Decision-Making:
   - Metadata provides essential context about each EO product. Users can assess its suitability, accuracy, and relevance to their specific needs.
   - Product sheets offer concise summaries, highlighting key attributes, spatial coverage, and temporal resolution.
2) Comparative Analysis:
   - By comparing metadata across different EO products, users can make informed choices. They can evaluate advantages over alternative resources like Google Earth Engine, Sentinel Hub (ESA), or governmental datasets.
   - Understanding the unique benefits of derived EO products empowers users to select the most suitable data source.
3) Demonstrating Value:
   - Detailed metadata and product sheets allow users to showcase the advantages of EO data to stakeholders, clients, or decision-makers.

- Highlighting specific features (e.g., higher resolution, specialised indices) reinforces the value of EO products.

4) Downloadable Documentation:
   - The EO web platform should include features for downloading metadata documentation alongside each product.
   - Users can access this information offline, share it with colleagues, or refer to it during project planning.

Visualisation of EO products during ordering:

Users highlight the importance of being able to Visualise EO products before purchasing, even if it involves a subscription for membership to preview it beforehand. Ideally, a web-based GIS view is preferable for an interactive presentation of the EO products however, having EO products in "PNG" could be sufficient for their needs to decide the suitability of the products before purchase.

GIS-based visualisation:

For those users who prefer visualising EO products within GIS software like QGIS and ArcMap, providing specific GIS styles for each EO product is highly beneficial. Here's why:

1) Customized visualisation:
   - GIS styles (such as symbology, colour ramps, and labelling) allow users to tailor the visualisation of EO data to their preferences.
   - Users can apply predefined styles directly to the EO layers, enhancing clarity and making the data more interpretable.
2) Consistent Representation:
   - By offering standardised styles to ensure consistency across different EO products.
   - Users can easily compare and analyse various datasets through a common visual language.
3) Ease of Interpretation: Well-designed styles enhance comprehension, like colour scales, transparency, and labels.

3.3. WIDER RANGE OF EO-DERIVED PRODUCTS FOR NATURAL HAZARD RISKS

Here is the list of other natural hazard products to be considered in the EO service web platform:

- Flood mapping is identified as an EO product with the highest natural hazard impact. It has been noted that there is a need to further advance flood information and mapping.
- Shifts in rainfall patterns can help to analyze trends related to changes in rainfall patterns by determining the likelihood of extreme rainfall events in specific regions. This information is crucial for disaster preparedness and risk assessment. Next, mathematical models and historical data can provide insights into how rainfall patterns are evolving.
- Soil moisture and heat hazard maps are very useful, particularly in agricultural applications.
- The impact of increased temperatures can affect soil moisture and vegetation conditions. Combining heat hazard maps with soil moisture data allows us to assess the impact of temperature increases on the agricultural sector, the country's GDP, and inflation.

The need for hazard products depends on whether the service targets private asset management or public investment strategies. For private asset management, the availability of asset data and specific locations is crucial. However, public investment strategies may require broader coverage across various locations. Beyond the provided hazards, stakeholders showed interest in additional natural physical risk products such as frost risks, coastal erosion, and sea level rise.

3.4. ACCURACY OF EO-DERIVED PRODUCTS

The accuracy of EO-derived products plays a crucial role in demonstrating their reliability. Banks and larger financial institutions follow a strict policy of not deploying any data or model without validation. This validation process ensures that EO data/products meet the required standards. Inside banks, there is a dedicated validation process for EO data/products. Banks validate the delivered EO data themselves to ensure accuracy and reliability.

It has been noted that an accuracy level above 80% is considered satisfactory for historical and observed data, while expected accuracy tends to be lower due to the inherent complexity of modelling climate dynamics.

3.5. FINANCIAL MANAGEMENT SECTOR

1) One of the features of an ideal EO web platform serving the FM sector is to adopt users' different expertise levels in using and processing geospatial datasets including EO-derived products. Below, you can see three different FM users' expertise levels with recommendations features for the EO web platform to address their needs.
   - Users without GIS expertise require simple outputs like CSV, PNG, or PDF files.
   - Users with basic GIS knowledge can handle more complex outputs.
   - Users proficient in programming languages can work with raw data.
2) Compared to the majority of financial institutions, insurance companies have varying levels of expertise in geospatial datasets using sophisticated algorithms to accurately assess and manage risks, leveraging EO datasets for natural disasters, climate change impacts, and asset vulnerabilities. These proprietary algorithms are kept confidential preventing the broader industry from benefiting from these innovations, potentially slowing the advancement of geospatial applications in the sector.
3) Compared to the smaller institutions with lack in-house forecasting teams and may rely on external services, large banks and insurance companies have substantial forecasting teams.

3.6. STAKEHOLDERS ENGAGEMENT

The EO-FIN project was highly engaged with financial sectors to acquire and consolidate the geospatial needs; define and develop the financial sector's best EO service; and understand the ideal characterisation of the EO service for successful commercialisation applications. The EO-FIN Team engaged with financial stakeholders through two sets of workshops (online and hybrid), one-to-one interviews, questionnaires (online and through email), meetings with stakeholder board members, and a webinar to the EO and FM community.

Compared to other sectors, the financial management sector is highly regulated and competitive with a proportion of secrecy. These factors resulted in the stakeholders are limited to sharing their opinions and their business practice information. To ensure the confidentiality of information shared and discussed during engagement with stakeholders the EO-FIN Team proposed the Chatham House Rule.

The process of attracting new stakeholders shall continue across the project life and not be limited to the initial part of the project and those who signed the letter of interest. This ensures that there is adequate engagement in case any of the stakeholders leave the stakeholder board. Also, during the project life, there are huge opportunities to reach new stakeholders with strong interests who bring significant benefits to the project.

To overcome the private firms' reluctance to share information, and to truly get to know the market from the inside, the EO-FIN team allocated the resources to sign a consultancy with two stakeholders who are members of the stakeholder board. The feedback and information provided ensure the EO-FIN team has deep access to sector/market-specific data and, in general, to the necessary insights and priorities to design and develop a prototype close to market, able to have a real impact on the business processes with chances of entering a commercial phase.

3.7. TOWARDS COMMERCIALISATION

The commercialisation of EO services in the financial management sector holds significant potential to revolutionise primary domains including investment management, risk management, insurance management and green finances. However, realising this potential requires EO service offering Characteristics required for the ideal EO service, overcoming key barriers, and demonstrating the value of EO-derived solutions.

Characteristics of the ideal EO service for FM

It was noticed that historical risk data is valuable for specific risk events by helping stakeholders make informed decisions based on past occurrences. Further, stakeholders appreciate having all risk hazard data accessible from a single platform. This centralised approach streamlines decision-making and risk assessment.

The current platform is useful for insurance companies to verify location impacts after disasters. Stakeholders showed a preference for such multi-natural hazard EO service to serve a variety of use cases and scenarios, for EO-derived products to be related to risks such as historical data (past risk events and patterns), probability of occurrence (assessing likelihood), forecasting (predicting future risks), and climate change projection (considering long-term impacts).

Recommended features of the EO web platform

- Is compatible with a wide range of formats and types of definitions AoI.
- Offers a full package of natural hazard products.
- Offers product visualisation (e.g., in PNG format) before purchasing and ordering.
- Provides detailed metadata and samples of products.
- Offers Various Format of the products according to the level of users.
- Expands the EO products in the probability of occurrence, forecasting, and projection of specific climate risks (climate risk scenarios).
- Providing further statistics including pixel counting and maximum to the current features including mean, median, and standard deviation at district and province levels.

Overcoming the current barriers:

Another driver to commercialise the EO service to overcome the barriers (section 3.1 Barriers) including cost considerations, lack of direct communication channels, lack of geospatial skills in the financial management sector, and complexity of IT systems.

The high cost of data and imagery can be addressed by leveraging public-private partnerships and open data policies. Governments and space agencies like the European Space Agency (ESA) have increasingly adopted open data initiatives, making vast amounts of freely available EO data. By encouraging collaborations between the agencies and private companies, it is possible to reduce costs associated with data acquisition. The cost of computation and storage can be reduced by adopting cloud computing and processing can facilitate the efficient processing and storage of large EO datasets, further driving down operational expenses. Further, implementing subscription-based models or tiered pricing strategies can make EO products more affordable and accessible to smaller financial institutions and emerging markets. Ideally, this approach can encourage innovation and scalability in the development of tailored financial management solutions by enhancing the sector's ability to leverage EO insights for risk assessment, investment management, and strategic planning.

Opening robust communication channels between financial users and EO service providers is key to the effective commercialisation of EO services in the financial management sector. Regular workshops, webinars, and joint development initiatives can help translate complex EO data into actionable insights tailored for financial applications, such as risk management, investment management, and market forecasting. It is expected that the feedback and findings drive iterative improvements in EO services, fostering innovation and customisation. Further, by promoting transparency and mutual understanding, these channels can bridge the gap between EO capabilities and financial sector requirements, ultimately enhancing the relevance and adoption of EO-derived solutions in financial decision-making processes.

The lack of technical skills and knowledge of handling and processing geospatial datasets can be addressed by providing targeted training courses for FM users. Training programmes such as workshops and real-world case studies enable users to develop the practical skills required to leverage EO data effectively. The training programmes can significantly enhance the integration of EO services into financial decision-making, thereby accelerating their commercialisation and adoption.

To overcome the complexity of IT systems in larger financial institutions and banks and facilitate the commercialisation of EO services, it is recommended to develop seamless integration solutions that align with existing banking infrastructure. This can be achieved through the use of standardised data formats, APIs, and interoperable platforms that allow EO data to be easily ingested within the current IT ecosystem. It is suggested that EO service providers collaborate with financial institutions' IT departments during the development process. This collaboration can ensure that derived-EO solutions meet security, compliance, and performance requirements specific to the financial sector. Further, adopting cloud-based EO services can reduce the burden on internal IT resources by providing scalable, flexible, and secure access to EO data. Finally, offering comprehensive technical support and user-friendly interfaces can further simplify the integration process, making it easier for financial institutions to incorporate EO insights into their workflows.

Demonstrating the value of EO-derived solutions

Adopting an EO-derived solution requires significant investment by financial intuition. This investment is not only limited to paying for service but also related to the cost of training and adopting EO-derived solutions in financial institutions. To encourage financial managers to have this investment. EO service providers should effectively demonstrate the value of EO-derived solutions by providing concrete examples and showcasing studies where EO-derived solutions have led to significant financial benefits. This could include instances where EO data improved risk assessment models for insurance companies, enhanced the accuracy of agricultural yield forecasts for investment portfolios, or identified environmental risks impacting real estate values. Further, EO service providers and financial institutions can develop pilot projects and collaborative research initiatives aiming to reach tangible proof-of-concept results. Finally, quantifying the return on investment through metrics including cost savings, improved decision accuracy, and reduced risk exposure can further highlight EO's practical benefits.

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