Global Development Assistance

Status Review Year 1

Status at January 2023

Caribou Space

www.caribou.space

Caribou Space supports organisations to bridge the space and sustainable development worlds by working with governments, space agencies, development agencies, and private sector space companies. Caribou Space provides:

» Official Development Assistance (ODA) fund and programme strategy: Strategic recommendations for the design and delivery of ODA programmes.

» Fund management: Large-scale ODA funds (£100M+) and seed-stage funds (£4M+).

» Monitoring and Evaluation (M&E): Design of M&E systems, delivery of process and impact evaluations, and M&E training.

» Research, communications, and knowledge sharing: Conducting research on market opportunities, user needs, use cases, and impact of space solutions. Sharing knowledge publicly of what works and doesn't work—and why—through diverse communications channels including press and media, publications, social media, conferences, and workshops.

» Programme management: Delivery of complex, multi-country, multi-million-pound programmes in lower-income countries.

» Product strategy: Supporting strategy for the sustainability and commercialisation of space solutions for lower-income countries.

» Economic evaluation: Quantification of the economic cases and impacts of space technology.

Contents

Glossary

ABC	Advancing and Building EO Knowledge and Capacity
ADB	Asian Development Bank
AID	Agile EO Information Developments
AOI	Area of Interest
APP	Analytics and Processing Platform
ARL	Application Readiness Levels
BE	Bank-executed
CCN	Contract Change Control
CCC	Communicate-Connect-Cooperate
CCDR	Country Climate and Development Reports
CS	Client State
DEP	Digital Earth Partnership
EO	Earth Observation
EO4SD	Earth Observation for Sustainable Development
ESA	European Space Agency
FFF	Fast EO co-Financing Facility
GDA	Global Development Assistance
GHG	Greenhouse Gas
GOST	Geospatial Operational Support Team
GPDRA	Global Program for Disaster Risk Analytics
ITT	Invitation to Tender

JDC	Joint Data Center
LIST	Luxembourg Institute of Science and Technology
M&E	Monitoring and Evaluation
MRV	Monitoring, Reporting, Verification
NBS	Nature-Based Solutions
NDA	National Development Agencies
OS	Open Source
PCSP	Pakistan Community Support Project
RE	Recipient-executed
R&D	Research and Development
SOW	Statement of Work
STC	Short-term Consultants
TO	Technical Officer
TTL	Task Team Leader

Executive summary

The European Space Agency (ESA) Global Development Assistance (GDA) programme is a global partnership to mainstream the use of satellite Earth Observation (EO) into development operations.[1]

It aims to bridge the awareness, acceptance, and adoption gap between developed countries and those developing countries (Client States) supported by International Financial Institutions (IFIs), such as the World Bank (WB) and Asian Development Bank (ADB), to ensure that they can equitably access, use, and benefit from satellite EO data.

This GDA Status Review is completed by Caribou Space as part of the M&E and Impact Assessment (GDA M&E) activity to assess the status and progress of all GDA activities as of January 2023. It identifies lessons and consequent recommendations for GDA related to programme processes and outcomes to maximise its potential impact. The GDA programme is relatively unique within ESA in having a dedicated programmatic activity to carry out M&E. Whereas this activity is commonly undertaken in the development assistance sector, it is rare within the space industry. Following a structured approach to M&E will enable ongoing learning and reflection of the programme implementation and will facilitate—where necessary—course corrections to be made to deliver the greatest possible impacts through the programme activities.

The GDA programme was brought to life by ESA Member States at the Space19+ Ministerial Council in November 2019, with the first contracts under the Agile EO Information Development (AID) activity line beginning in September 2021—meaning this evaluation falls just past the first full year of activities.

Implementation of GDA

GDA has started work with seven GDA AID consortia, who began developing 36 distinct EO Information products for 32 IFI projects in 40 countries during the reporting period. An additional 30 products are in active discussions with IFI projects, with work expected to begin in 2023.

GDA is seen to have established its core processes effectively and efficiently in delivering the AID activities. The use of an agile methodology has helped meet user requirements, although at times asynchronous development cycles have made the activities more challenging to manage.

Therefore, suggested recommendations represent adjustments to programme processes to maximise the potential impact and effectiveness of GDA.

> » **Budgets and project management:** Agile development is central to GDA AID activities, with production of EO Information organised into three sequential agile cycles of six months each. Within the boundaries of ESA contracting processes, acknowledging flexibility in the product development cycle and matching that to flexibility in payment schedules is likely to reduce frictions faced by consortia.

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1   ESA, About GDA, https://gda.esa.int/about/

» **IFI engagement and coordination:** GDA AID consortia continue to struggle (although to a significantly lesser degree than at the start of GDA) with engaging IFIs in a timely and streamlined way—as required by the tight turnaround schedules expected for GDA. Additional support within IFIs to help streamline engagement, more "user-friendly" communications materials (supported via GDA Communicate-Connect-Cooperate (CCC)), and in-person visits of consortia to IFI counterparts and CS representatives (as Covid-19 travel restrictions have lessened) at key feedback points are recommended as approaches to improve the engagement process.

» **Handover, costs, and future uptake:** No GDA AID activities are yet at a point of handing over their solutions to IFI counterparts, and concerns have been raised about the success of this transition. It is expected that the completion of the first agile iteration cycles will subsequently provide each GDA AID activity more leverage to mobilise complementary activities and funds at the IFIs. To maximise the likelihood of future uptake, GDA AID activities would benefit from greater clarification about handover expectations (e.g., the amount of product level training, or guidance documentation expected to be included in their handover activities) and transparancy with IFIs on costs of the final solutions (and applicability of open-source options). IFIs could utilise their complementary financing to fund phased transitions—where services are subsidised by IFIs for their Client States for an agreed timeframe.

Innovation is central to GDA, is valued by ESA, IFI teams and consortia, and should continue as a GDA requirement. However, ongoing clarification is needed about the expectations and boundaries of what classifies as innovation, and the balance needed between innovation and satisfying IFI needs for a (sometimes) quick-to-implement solution.

Impacts of GDA

Awareness

Existing levels of experience and expertise with EO specifically (and geospatial and remote sensing generally) vary within IFIs and are lower within CSs; however, there has been growth in awareness over recent years. GDA has helped advance this process by engaging with IFI staff on the potential use cases of EO, the ability to customise solutions, the understanding of jargon and technical knowledge, and the ways EO can be applied to specific thematic areas. To further support changes in awareness at IFIs, recommendations identified the need for more easy-to-understand promotional materials, short trainings, and promotional activities from AID consortia and IFI and ESA teams that help communicate with non-technical audiences.

Value creation

At this point in GDA, technology development cycles are still in progress, and only 11 products have been handed over to users for their feedback.[2] All of these products still have further iterations of development cycles to go through before they are delivered to their CS users for ongoing use. Although there has been limited time for IFI staff to report on examples of value creation for their CS, those staff are optimistic and report that "*there is a lot of enthusiasm*" about the EO Information to be developed. In particular, the continuity and coverage offered by satellite EO have been highlighted as value anticipated by IFIs and CSs.

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2   At the time of writing (December 2022/January 2023), however, another 10+ were in the process of being handed over to IFI teams for a first round of feedback.

Mainstreaming within IFIs

Mainstreaming is the process by which EO Information becomes/is a standard input/approach available for IFI projects. At this stage of GDA, although some Earth Observation for Sustainable Development (EO4SD) (the GDA precursor programme) activities have led to follow-on CS loans or procurements, it is too early for the GDA AID EO Information to have been taken up in this way. There are positive signs that the foundations are being laid for long-term mainstreaming in the future. Most notably, IFI partners have already identified several opportunities where they would be interested in expanding and replicating the EO Information to new geographies. For example, several companies within the Disaster Resilience consortium (the first GDA AID) have expanded their support to the ADB via new contracts, thanks to the interactions with the IFI teams and their showcasing of the capabilities of EO data. But at this stage it is too early for the EO Information to have been incorporated widely into CS loans or procurements, which are indications of broader mainstreaming. Therefore, while this growth has been positive, it is not enough to suggest that EO Information has been "mainstreamed" within IFIs yet.

While allowing more time for mainstreaming is expected to have a positive impact, several recommendations have been identified to address these barriers and maximise the potential for mainstreaming. These include: investing more in, and being clear about requirements for, capacity building (including where basic product-level training may sit with GDA AID activities); focusing on activities where EO can be used in large-scale IFI processes and programmes; supporting broader spatial data infrastructure and institutions in CSs (to maximise benefits); and increasing engagement between GDA and IFI senior leadership.

Impact within IFIs and Client States

At this stage in the programme, GDA AID activities have not progressed sufficiently to be able to assess impact of this kind, but the evaluation questions and methods are designed to ensure that it is possible to identify any of these impacts should they occur in the future.

Conclusions

After just over a full year of activities, GDA has made significant achievements. In the coming year, the first of the GDA AID activities will begin to end, and it will be possible to begin to assess the early impacts of these collaborations and EO Information more concretely. At the same time, additional activities (AID and others) will be launched—creating a more comprehensive programmatic approach. Finally, it is anticipated that IFIs will increase their implementation of complementary activities that will benefit GDA and the wider Space for International Development Assistance cooperation framework.

1 Background

Satellite EO is the gathering of information about the physical, chemical, and biological systems of the planet via remote-sensing technologies. ESA's GDA programme is a global partnership to mainstream the use of satellite EO into development operations.[3]

It aims to bridge the awareness, acceptance, and adoption gap between developed countries and those supported by IFIs, such as the WB and ADB, to ensure that they can equitably access, use, and benefit from satellite EO data. GDA is powered by ESA and implemented in partnership with the WB and ADB. ESA's role is focused on technical solutions developed by thematic consortia (GDA AID[4] activities) and a series of cross-cutting activities to fill gaps not met by the AID activities. The IFI partners align capacity-building and skills transfer activities to complement the solutions developed. See Annex 1: GDA Structure for detail.

FIGURE 1: GDA's Programmatic Structure and Activities
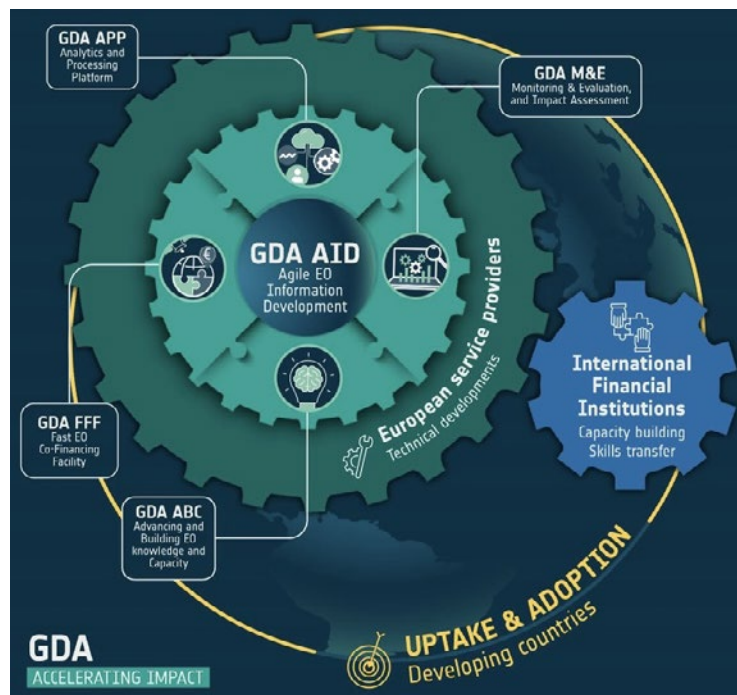
This GDA Status Review is completed by Caribou Space as part of the Monitoring and Evaluation and Impact Assessment (GDA M&E) activity. The objectives are to assess the status and progress of all GDA AID activities as of January 2023. It identifies lessons and consequent recommendations for GDA related to programme processes and outcomes to maximise its potential impact.

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3   ESA, About GDA, https://gda.esa.int/about/
4   GDA Agile EO Information Developments

Methods

Caribou Space has developed a measurement system to articulate, track, and understand GDA's impact.[5] See Annex 2: Methodology for detail. The core of this framework consists of a Theory of Change, summarised by this video, and aligned indicators for robust measurement (see Annex 3: GDA Theory of Change). This enables tracking of progress towards intended impacts and learnings to optimise the implementation of the programme. Caribou Space supports GDA AID activity consortia and IFI programmes and projects to gather indicators and insights to track progress on a quarterly basis.

To complement ongoing programme monitoring, key informant interviews (KIIs) have been conducted with 22 representatives from WB, ADB, ESA, and the GDA AID consortia.

GDA is still in an early stage of implementation, which has been the primary limitation to this review. It was brought to life by ESA Member States at the Space19+ Ministerial Council in November 2019, with the first AID activities beginning in September 2021—meaning this evaluation falls just past the first full year of activities.

Of those launched activities, two have completed the first cycle of technical EO Information products and received feedback from IFI and CS partners, and an additional two have completed the first cycle and are awaiting feedback from stakeholders.

Most of the cross-cutting activities planned have not yet been launched (except for GDA M&E). Consequently, the impacts of GDA, in terms of awareness, value creation, mainstreaming, etc., are less advanced than anticipated in future iterations of this Status Review, and the focus of this review will be on the GDA AID activities. Future updates in December 2023 and December 2024 will include increased focus on cross-cutting activities and IFI-led complementary activities.

This GDA Status Review will be updated on an annual basis and published to the GDA website.[6] In addition, there will be published a Space for IDA Review in early 2023 and 2025, which will analyse the wider Space for International Development Assistance cooperation framework, complementary activities, and broader uptake of EO Information products at the involved IFIs.

Navigation

1. **GDA implementation** outlines the structure and core processes of GDA, including objectives and outcomes related to innovation within the GDA AID activities. It also includes reflections on the programme's learnings to date and recommendations for implementation going forward.

2. **GDA impacts** describes the main outcomes and impacts to date because of GDA for IFIs and CSs. This includes changes in awareness of EO capabilities, applications, and impacts, as well as the specific benefits provided by EO Information products and analysis of the barriers faced to date in relation to the uptake and mainstreaming of EO by IFIs and CSs.

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5   David Taverner and Niamh Barry (Caribou Space), Christoph Aubrecht (ESA), ESA's GDA programme invests in understanding and generating impact, June 2022, https://gda.esa.int/story/esas-gda-programme-invests-in-understanding-and-generating-impact

6   ESA, Global Development Assistance, https://gda.esa.int/

2 Implementation of GDA

The GDA programme was brought to life by ESA Member States at the Space19+ Ministerial Council in November 2019, with the first AID activities beginning in September 2021—meaning this evaluation falls just past the first full year of activities.

Over the course of its first full year of implementation, GDA has started work with seven GDA AID consortia and begun work on GDA M&E. From this, GDA AID consortia have begun developing 36 distinct EO Information products for 32 IFI projects in 40 countries. An additional 30 products are in active discussions with IFI projects, with work expected to begin in 2023.

This section outlines the structure of GDA and its core processes and assesses how innovation is being incorporated within the GDA AID activities. It then provides reflections on the programme's learnings to date and recommendations for implementation going forward. The evaluation questions this section addresses include:

Has GDA been implemented effectively and efficiently?

- » To what extent has the agile development approach been adhered to?
- » How effective has it been in designing products that meet users' requirements?
- » What lessons can be gleaned from implementing the agile development approach?

How has innovation been incorporated into GDA?

- » Have the EO Information developments been assessed to advance EO state-of-the-art, and in what way (e.g., accuracy, timeliness, simplicity)?

Programme structure and processes

GDA is currently composed of activities dedicated to seven thematic areas following an Agile EO Information Development (GDA AID) approach that will provide EO Information in response to requirements identified by IFIs and their CS governments in developing countries and an M&E activity to support impact reporting from GDA. Additional cross-cutting activities are planned to include communications, a knowledge hub, a user-oriented analytics platform, and a fast-financing facility to fill gaps not met by the AID activities.

GDA is implemented in partnership with IFIs—WB and ADB—under the joint Space for International Development Assistance (Space for IDA) cooperation framework. These IFIs are complementing GDA's technical developments through capacity building for development stakeholders and skills transfer. See Annex 1: GDA Structure for detail.

Key findings

GDA is seen to have established its core processes effectively and efficiently. It has initiated a wide array of activities in support of the IFIs and CSs by onboarding seven consortia with 38 European organisations. The consortia are engaging well with IFI teams and underway to produce a wide variety of EO Information—there are 36 individual EO information products (in development) supporting 32 IFI projects. The geographical spread of the programme is wide, covering 40 countries across Latin America, Africa, Central and Eastern Asia, and Eastern Europe. Therefore, the recommendations in this section are suggested adjustments to programme processes to maximise the potential impact and effectiveness of GDA.

The recommendations included in this section centre around three themes:

» **Budgets and project management:** Agile development is central to GDA AID activities, with production of EO Information organised into three sequential agile cycles of six months each. Within the boundaries of ESA contracting processes, acknowledging flexibility in the product development cycle and matching that to flexibility in payment schedules is likely to reduce frictions faced by consortia.

» **IFI engagement and coordination:** GDA AID consortia continue to struggle (although to a significantly lesser degree than at the start of GDA) with engaging IFIs in a timely and streamlined way—as required by the tight turnaround schedules expected for GDA. Additional support within IFIs to help streamline engagement, more "user-friendly" communications materials (supported via GDA CCC), and in-person visits of consortia to IFI counterparts and CS representatives (as Covid-19 travel restrictions have lessened) at key feedback points are recommended as approaches to improve the engagement process.

» **Handover, costs, and future uptake:** No GDA AID activities are yet at a point of handing over their solutions to IFI counterparts, and concerns have been raised about the success of this transition. It is expected that the completion of the first agile iteration cycles will subsequently provide each GDA AID activity more leverage to mobilise complementary activities and funds at the IFIs. To maximise the likelihood of future uptake, GDA AID activities would benefit from greater clarification about handover expectations (e.g., the amount of product, level of training, or guidance expected to be included in their activities) and transparency with IFIs on costs of the final solutions (and limitations of open-source options). IFIs could utilise their complementary financing to fund phased transitions—where services are subsidised by IFIs for their Client States for an agreed timeframe.

Procurement and pre-Kick-Off

GDA has rapidly launched new activities since the start of the programme

GDA has launched activities in seven thematic areas and one cross-cutting activity by January 2023, with another four in the procurement process.[7] This is a rapid scale up of a new programme involving onboarding 38 organisations within those consortia.

The predominant limiting factor for ESA in initiating procurements is the dependency "*on the availability of technical officers from across the department, in terms of when we launch activities and what we can launch*" (Christoph Aubrecht, ESA). Technical Officers (TOs) to lead each activity are allocated from other units within ESA's Earth Observation Directorate to ensure they have the highest level of technical expertise for the domain, but those TOs have existing responsibilities in ESA, so the allocation of new GDA responsibilities can take time.

Benefit of complementing EO skills with non-EO skills within the consortia

Consortia are complementing their teams with skills in non-EO data to ensure the optimal solution is provided to address an IFI's development challenge, for example, EO data being combined with non-EO (ancillary) data such as that from social media, ground sensors, census, etc. This ensures GDA AID activities go beyond EO as stand-alone service towards more of a packaged approach for IFIs. This is viewed as highly beneficial by the IFIs who focus on solving the development challenge, and not on utilising a specific type of technology.

> *"The main benefit so far is saying this is the problem, and then being able to say, we can look at EO data, we can look at social media data to help find answers. This is what we can do in those two realms."*
>
> **Paul Prettitore, WB**

However, the challenge with incorporating non-EO skills in the consortia is that, until the exact use cases are agreed with the IFIs (in cycle one), the required functional or thematic skills are unknown. But the consortium structure and the underlying team need to be included in the Invitation to Tender (ITT) proposal. As a result, use cases are somewhat defined by a mixture of what data is most useful and what skills are available within the consortium.

Additionally, including non-EO skills in the consortia, in some instances, makes it more difficult for the prime to take the lead and represent the expertise of all companies during the engagement phase with IFI teams. As a result, consortia need all parties represented at meetings with IFIs while use cases are being defined. This has led to confusion and overcrowded meetings from the perspective of IFIs.

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7   Water Resources, Communicate-Connect-Cooperate (CCC), Advancing and Building EO Knowledge and Capacity (ABC), Analytics and Processing Platform (APP)

GDA's team structure with "ESA representatives" and TOs is critical to GDA implementation

GDA has a team structure that includes ESA staff who have been seconded full time to both the WB and ADB. These ESA representatives have access to WB and ADB teams, systems, and processes and are based at their headquarters. They act as a crucial link between the IFI teams, ESA, and the consortia, raising awareness of GDA, supporting coordination, and acting as "translators" between IFI staff and consortia teams. "*The ESA representatives' mediation has been fundamental throughout the whole process, including, critically, for translating the very technical jargon for us and the client*" (Maria Pia Ancora, ADB).

In addition, each GDA AID activity (e.g., Urban Sustainability) has an ESA TO. Whilst the ESA representatives have a broad role that cuts across all GDA activities, the TOs are the domain experts and the ESA lead for that thematic area. Feedback from both IFI projects and consortium leads report that ESA TOs are "*very responsive, very good at listening. And this facilitates very much the relation with the consortium* [and IFI team]" (Elizabeth De Benedetti, ADB).

In contrast to the WB, ADB has hired Short-Term Consultants (STC) to support GDA and manage the interface between consortia and IFI projects. These STCs understand ADB's programmes, the thematic area, and EO and are seen to have helped move projects along more quickly than solely relying on IFI project and programme leaders to engage directly with the GDA AID activities. However, the disadvantage of this is the risk of GDA AID work becoming disconnected from the end users of the EO Information. While this is an ingrained way of working at ADB, there have been reports from consortia that, at the WB in particular, it gives the sense of work being "offloaded" onto STCs, and the potential for true integration and mainstreaming is undermined.

Technical development cycles

IFIs highly value consortia's technical ability and responsiveness

GDA AID consortia are comprised of many organisations from the private sector and academia.[8] The consortia are often large to ensure there is breadth and depth to the EO technical abilities and the understanding of the domain—which has been highly valued by the IFIs and allows for specialisms to different use cases. IFIs also reported appreciating ESA's role in "pre-selecting" the best industry partners for a given set of EO Information in the domains of interest to the IFIs by awarding contracts to highly qualified consortia teams for each of the GDA AID activities. The consortia are "*really great at understanding what we need and providing practical solutions for the team, and for the client*" (Maria Pia Ancora, ADB). This positive view of AID teams also extends to their availability and responsiveness.

However, a challenge noted by the IFIs, particularly in the initial engagement during cycle one, was the size and complexity of the consortia. For the IFI teams this can be confusing in terms of who is involved, in which role, and who to follow up with.

> "*Understanding how the consortium was organised was a bit difficult and there were a lot of early discussions with huge numbers of people, and I was never really sure who I needed to follow up with. Once they reached the process of the one organisation that was the lead for my work, then the process became much smoother.*"

Paul Prettitore, WB

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8   To date, the largest consortium in GDA has nine members, and four is the minimum.

A more streamlined process for introducing each GDA AID activity and the consortia members' capabilities may help improve this process.

User requirement gathering benefits from simple communication of capabilities

At the beginning of each GDA AID activity, the ESA representatives to the IFIs facilitate a process of identifying potential project teams that might be interested to engage with GDA. This initiates an intensive consultation process and gathering of user requirements to further define the potential use cases for EO data and the intended EO Information developments. A wide language and understanding gap exists between teams which complicates the user engagement process. Both sides need to move quickly up the learning curve to come to a shared understanding of the domain challenge and the potential EO solution. The GDA AID Urban Sustainability consortium has produced a "brochure"[9] and a video[10] for non-technical audiences, showing EO products from other work prior to GDA, to introduce their capabilities and potential offering to IFIs.

From 2023, the GDA CCC activity will help address this via its objective to *"strengthen the branding, visibility, and impact of GDA through professional strategic communication and visual storytelling."*

Increase the agility of the user requirements gathering process

The GDA AID ITT contains an initial list of use cases for EO Information, for example, "irrigation management performance" in agriculture. These are defined by ESA using their understanding of the EO industry, the thematic area, and input from the IFIs via ESA representatives. They provide a "first view" of technical scope, from which the consortium lead can then identify consortium members with necessary technical skills. However, as is common in user requirements gathering, following engagement between the consortia and IFIs, the use case priorities become more specific, and the level of IFI demand and engagement across the use cases becomes clearer. This can lead to a resourcing mismatch in the consortia. For example, some anticipated use cases might not be required, and there might be over- or under-demand for specific use cases. While ESA has been seen to be helpful at times with enabling the consortium to be flexible, "*at the end, the burden of changing swiftly the allocation of resources—to adapt to evolving needs—is on the consortium*" (Alberto Lorenzo, Indra).

In addition, whilst the GDA AID SOW refers to the use of sprints[11] as a recommended agile technique for consortia to use, the reality is most consortia collect IFI requirements via many calls over an extended period. It has been suggested that it may be more efficient to have the prime and/or the EO companies working on each use case physically visit the WB and ADB teams at the start of cycle one to conduct an intensive sprint-based requirements gathering. This, however, would require significant coordination between the IFI teams and EO companies to ensure that teams can dedicate the required resources (time and appropriate staff) to participate.

9   Caribou Space for GDA Urban, Global Development Assistance Urban Sustainability, 2022, https://gda.esa.int/wp-content/uploads/2022/11/ESA-GDA-Urban-Brochure.pdf

10   Caribou Space for GDA Urban, Introduction to ESA Global Development Assistance—Urban Sustainability, 2022, www.youtube.com/watch?v=vgRD9CdIKms

11   Teams use a structured process to define a specific amount of work to be done in a set period.

Triangular requirements gathering between consortia, IFIs, and CS

EO companies involved in GDA are primarily engaging with IFI projects as their stakeholders. However, IFIs operate to serve the needs of their CS governments, creating a more complex relationship between service providers and users in CS/recipient-executed (RE) activities.[12] When this works, it aids future adoption by ensuring that the EO Information is tailored to the needs and priorities of the CS users. However, it also creates challenges as it complicates and can slow down the requirements gathering process or reveal differences in priorities between IFI and CS teams.

> *"We discuss and agree the solution with the IFI, then the IFI needs to agree with the Client State government and then we might need to start again or abandon the solution because the government and the bank have different views."*
>
> **Carlos Domenech, GMV**

Additional deliverables to clarify scope of work between AID activities and IFI projects

The Disaster Resilience consortium has tested adding supplementary deliverables that help articulate plans between the consortium and IFI. It has also included technical specifications documents for each use case that clearly articulate (for the IFI) the expected EO Information requirements so that there is a shared understanding of the final products. While it is too early to assess if these deliverables have significantly impacted the quality of the engagement or the EO Information developed from the perspective of the IFIs involved, both the consortium and the ESA TO were very positive about the additional value these brought.

Alignment of GDA AID development cycles with IFI project cycles, and ESA payment milestones

Agile development is central to GDA AID activities, with production of EO Information organised into three sequential agile cycles of six months each. The proposed benefit of this approach is to rapidly develop, test, and iterate the EO Information with close collaboration and feedback from the IFI.

However, whilst IFIs have ambitions to shift to more Agile Global Development,[13] most IFI projects still follow a cycle[14] that is structured in a traditional, waterfall project management model. As a result, it is difficult for consortia to insert their six-month development cycles into the timelines of each IFI project—often leading to significant deviations from the clear six-month cycles. Additionally, the IFI teams also require the engagement, buy-in, and agreement on user requirements from the Client States, which is critical to ensuring future demand and adoption, but can create uncertainties and delays on the timelines.

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12 This is not an issue in bank-executed (BE) activities, such as Country Climate and Development Reports (CCDRs), which do not involve CS teams. Recipient-executed (RE) activities are projects or programmes implemented by a third-party recipient for which the WB provides trust fund resources to the recipient under a Grant Agreement. BE activities are development activities carried out by the WB as part of its regular work programme. BE activities include project identification and appraisal, project implementation support, etc. World Bank, Partnering with the World Bank through Trust Funds and Umbrella 2.0 Programs, 2021, https://thedocs.worldbank.org/en/doc/448b37c5ab031f2645de278e5ef39c24-0060072021/original/DP-Guide-2021-FINAL.pdf.

13 Chris Vein and Joshua Goldstein, Agile Global Development: Using Technology to Fight Extreme Poverty, World Bank Blog, 7 October 2013, https://blogs.worldbank.org/voices/agile-global-development-using-technology-fight-extreme-poverty; Owen Barder, Science to Deliver, but No "Science of Delivery," Center for Global Development, 14 August 2013, www.cgdev.org/blog/no-science-of-delivery

14 World Bank, World Bank Project Cycle, www.worldbank.org/en/projects-operations/products-and-services/brief/projectcycle

At the same time, ESA's contracting and payment processes are traditional (payment for milestone deliverables) and timed at the end of each six-month development cycle—where in practice for each IFI engagement, cycles may range from two to nine months.[15]

> "*Some* [IFI teams] *are able to get the buy-in of the beneficiary institution in just one or two months whereas for other teams it can last around six months or more … It really depends on how the project or programme is framed on its level of advancement and also the motivation of the Task Team Leader (TTL). One of the challenges for ESA is that the GDA activities are organised in iteration cycles with common milestones and disbursement milestones for all projects that are being supported through the activity. Therefore, it is sometimes difficult to align the actual advancement of each engagement and the common milestones that trigger disbursement to the whole consortia for each GDA activity.*"
>
> **Alex Chunet, ESA representative to WB**

Eighteen-month development timelines are initially difficult to achieve

The first GDA AID activities were planned as 18-month contracts, split into three six-month cycles. Particularly for the first GDA AID activities, this timeline was difficult to achieve as the process of engaging and agreeing priority use cases with IFIs and CSs took longer than anticipated. Subsequently, GDA has extended the duration to 21 months.

Overall, stakeholders have reported that adjusting to 21 months has been appropriate. However, further timeline extensions would unlikely benefit the consortia, ESA, or IFIs—more likely is that time required would expand to time available. Also, for consortia, further extending timelines without budget changes can incur overhead costs that can lead to financial losses on the activity. Further extending timelines is viewed negatively by consortia "*because you always have to stop an EO Information production process* [in order to] *consult again. And every time there's a delay, it's a cost factor for us*" (Sharon Gomez, GAF AG).

Gaining user feedback

User feedback is a key part of the agile software development process and is used to refine the application according to more accurate user needs. When developing business or consumer-facing software applications, this feedback can be gained often automatically from the high volume of users via, for example, product usage data or A/B testing.[16]

However, in GDA with the IFI and CS teams, there are often only a few direct users. Therefore, these automatic feedback mechanisms are replaced by manual mechanisms such as user interviews and surveys. IFI teams have highlighted concerns on "*survey and interview fatigue*" and the amount of time required from them to provide feedback. This issue has been compounded by additional survey and interview processes executed in the GDA M&E activity, as the first round of IFI feedback for many consortia coincided with this review process. Greater involvement of IFI teams in the co-design/co-development process would reduce the need to gain feedback in the later stages. Also in the future, better planning, as well as having more time to space out activities, should help to relieve this fatigue.

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15   Caribou Space, GDA AID Quarterly EO Product Monitoring, 2023.

16   A/B testing is a way to compare two versions of something to figure out which performs better. Harvard Business Review, A Refresher on A/B Testing, 28 June 2017, https://hbr.org/2017/06/a-refresher-on-ab-testing.

Balance between open source (OS) versus licensed products

The EO Information developments provided by the consortia can either be open source (OS) with no future licensing costs and potentially minimal ongoing service costs, a proprietary solution that requires ongoing licensing costs, or a hybrid with continued development and maintenance shared between the IFIs and consortia. IFIs and their developing world CS governments often have significant budget pressures, and IFI teams are often advocating for OS, as it can minimise ongoing costs, facilitate faster replication and expansion, and reduce future dependence on specific providers. Where users have software development capabilities, OS solutions can be customised and replicated to different contexts, potentially amplifying development impacts beyond the confines of the original project.

However, the EO Information developments produced in GDA are expected to be sophisticated and tailored to each specific use case. Producing innovative and specific EO Information developments for the complex use cases in GDA has significant costs, and it is not always possible to have a completely (free and) OS solution. Identifying fit-for-purpose solutions that are not cost prohibitive is key for the consortia who may not fully understand the cost pressures of the IFIs' operating environment.

Therefore, there can be misaligned expectations between IFIs and the consortia about the significant costs and value of such customised solutions. It is in fact the core business model of many private sector organisations within GDA to own and market EO Information-based solutions as intellectual property. While this tension has been well navigated within GDA to date, it continues to need to be managed in future collaborations.

> *"They want an autonomous, open-source solution … and this is going against our business model because we are not developing software, we are downstream service providers of EO-based solutions."*
>
> **Carlos Domenech, GMV**

Nevertheless, the desire for OS is unlikely to decline within IFIs in the near future, and GDA AID activities should be prepared to work with IFIs to balance their expectations and wishes with what they can practically provide.

Post-contract

Optimising for follow-on commercial opportunities and adoption

Consortia view the visibility and potential for follow-on commercial opportunities outside of the GDA contract with IFIs and CSs as a major incentive for their involvement. Equally, this is an incentive for the GDA Participating States who wish to grow their domestic EO industries. It gives participating European organisations an "*understanding of the way the IFIs are operating their programmes, and their strategic interests*" (Sharon Gomez, GAF AG).

However, there is no guarantee for follow-on opportunities as IFIs and CSs are responsible for their own future procurements. This is particularly true for recipient-executed (RE) activities compared to bank-executed (BE) activities because the consortia are one step removed from the CS decision-makers for future procurements. However, the volume of financing via RE activities is much higher so over the long-term is expected to lead to greater adoption of EO.

As it stands in GDA, services are provided free of charge until the end of the activity and then offered to continue afterwards at commercial rates. Past cases have shown that, where there has been willingness to continue service provisions, it can ultimately fail due to the sudden increase in price from zero to the full-service fee.[17] To mitigate the risks that the EO Information developed under GDA won't be acquired commercially, key strategies that could be used include:

» IFIs utilise their complementary financing to fund phased transitions in which services are subsidised by IFIs for their CSs for an agreed timeframe.

» Encouraging consortia visibility with decision-makers and budget holders in IFIs and CSs.

Recommendations to improve processes and structure in GDA

Recommendations for ESA

Create scalable budgets

Implementing GDA activities with scalable budgets would allow flexibility to align with movements in the overall GDA budget. For example, the Fast EO co-Financing Facility (FFF) can easily scale up and down the number and size of its procurements.

Consider including OS more explicitly in GDA AID SOW

ESA should consider if it is necessary to include OS requirements more explicitly in GDA AID SOWs to ensure that companies are aware of IFI needs for OS and are prepared to implement EO Information products that take advantage of OS and demonstrate the added value of proprietary elements layered into the solution.

Acknowledge flexibility within the agile approach

Within the boundaries of ESA contracting processes, having agility in how GDA AID activities, overall project workplans, and milestones are managed by ESA would balance well with the level of agility expected in the GDA AID activities. ESA TOs should continue to use their judgement when managing agility and milestones.

Consider IFI-funded transition phases

Phased transitions—where GDA AID activities (led by ESA) initially provide the EO Information products, followed by a phase with IFIs subsidising service delivery on behalf of client states (e.g., 50/50 IFI/CS funded with gradual increases in client contributions, up to 100% CS funded)—will help reduce the risk of funding drop-off and low IFI uptake.

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17   GMV, GDA CLIMATE Final Report (D5), 2022.

Recommendations for IFI projects and ESA representatives

Support consortium visibility

For RE activities, supporting consortia to attain the right level of visibility and awareness within IFIs and CSs is beneficial, particularly with decision-makers for future procurements.

Recommendations for GDA AID consortia

Transparency with IFIs on costs and limitations of OS

Consortia should be expected to provide a balanced view with clear advantages and disadvantages of OS and proprietary solutions to the IFI teams and CSs for specific use cases, as well as an openness to implement OS elements in their solutions. Demonstrating to IFIs the difference in customisation and specifications will be a crucial element of showing the added value of proprietary elements. This should be done whilst also managing expectations from IFI and CS teams that not all the EO Information created in GDA can be produced as OS.

Consolidate and target feedback requirement

Consortia should make every reasonable effort to consolidate feedback requests to IFI and CS counterparts. For example, if a single IFI is receiving EO Information from multiple consortium members, a single survey or interview guide should be prepared that covers feedback on all products in a single process. Having well-prepared interview guides or digital survey instruments in advance of requesting feedback will help facilitate this.

Additionally, GDA AID activities should carefully consider whose feedback is needed, and on which elements. TTL and budget holder feedback is required to support M&E processes, but more practical user feedback may be needed to refine EO Information products. Different feedback tools can be applied for different audiences to ensure that questions are targeted to the right audiences.

Create user-friendly communications materials

Consortia would benefit from producing "user-friendly," non-technical communication materials as early as possible in cycle one, including highlighting related EO Information products from work prior to GDA. The GDA CCC is expected to support this via the objective to *"strengthen the branding, visibility, and impact of GDA through professional strategic communication and visual storytelling."*

Streamline representation

Initial meetings with IFI counterparts should have the minimum possible attendees (i.e., two or three) from the consortia. The consortium prime should be able to present the capabilities of other consortium members, including the non-EO skills (to the best of their ability), and conduct initial scoping on user needs to identify the appropriate "leads" for further engagement.

In-person sprints and engagement

As Covid-19 travel restrictions have now lessened, consortia should include travel budget and time required to conduct visits to WB and ADB HQs for sprint-based user requirements gathering in cycle one. For RE activities, consortia should aim to visit CS users to strengthen the user feedback process, thereby enhancing the technical developments in the next cycles.

Recommendations for GDA M&E

Streamline M&E data collection processes

During Q4 2022, Caribou Space became aware of an issue raised by the IFIs in terms of duplicative M&E data collection processes and subsequently streamlined them. This was done by reducing requests for interviews directly with IFIs and instead relying on feedback already gathered by consortia. In 2023 and beyond, this process will be further improved as consortia will implement survey tools required by Caribou Space to gather generic feedback from IFIs, thus reducing the need to conduct additional interviews and have somewhat duplicative processes. To ensure this is successful, Caribou Space will need to continue to emphasise the M&E requirements to ensure that consortia are gathering data against the required metrics and sharing that information in the appropriate formats.

Innovation

Innovation is central to the satellite EO industry. GDA AID consortia have a specific requirement within their SOW related to innovation: "*The EO Information product required shall be pre-assessed as feasible to implement as prototypes within 2–3 months; i.e., they shall consist of pre-operational developments, as opposed to basic research*" (Work Requirement (WR) 4). In addition, "*the EO Information products are encouraged to make full use of the latest innovative technologies and methods; e.g., Big Data, Cloud Computing, Artificial Intelligence (AI), Internet of Things (IoT)*" (WR 5).

Key findings

The requirement for innovation is valued by ESA, IFI teams, and consortia, and should continue as a GDA requirement. However, clarifying the expectations and boundaries of what classifies as innovation to reduce the risk of mixed interpretations across the consortia would be beneficial for future thematic activities. For example, by clarifying that process innovation is as valid as product (EO technology) innovation and by communicating expected Application Readiness Levels (ARLs).

There is a balance to strike between innovation and satisfying IFI needs in GDA for a (sometimes) quick-to-implement solution. While consortia are managing to navigate this issue, further clarification that IFI needs take priority over innovation (despite the SOW WR 4 and 5) will be important moving forward.

Finally, there are nascent examples of innovation emerging in the GDA AID activities, mainly in integration of non-EO data and advancing the state-of-art of EO Information products and IT infrastructure. It is expected that this will continue to develop as activities move into further product development cycles.

Incorporating innovation in GDA

Innovation in GDA is focused on the downstream stages of the EO industry

GDA is delivered via EO Information aligned to thematic areas. Activities are focused on the downstream part of the EO industry—which is the conversion of data into value-added products and services for use by end users using data processing methods and integration with other data sources. GDA does not focus on activities or innovation in the upstream[18] or midstream[19] EO industry. As a result, "*the type of [EO] data used does not always need to be intrinsically innovative, however the innovation can be in the methods used to analyse it and to provide interesting insights. I would qualify this as technological innovation as it often relates to data science techniques, cloud computing, machine learning, and other new innovative analytics technologies across the board*" (Alex Chunet, ESA representative to WB).

FIGURE 2: Section of the EO Value Chain that GDA Focuses On

IMAGERY & DATA → IMAGE & DATA PROCESSING → DATA INTEGRATION & INTERPRETATION → EO INFORMATION PRODUCTS

The level of innovation is expected to increase through the three development cycles

Consortia Project Managers and TOs highlighted that in cycle one some use cases are being addressed using what might be considered "innovative methods," whilst others are more traditional and quicker-to-implement solutions. The perception is that this has happened because of being "*pressed for some [IFI] teams to see things that the consortium could come up with immediately. So, most of the things that I've seen so far have not been innovative*" (Tania Casal, ESA). Achieving quick wins with the IFI teams has been an important part of the first development cycle, incorporating more innovation and customisation in subsequent cycles and iterations.

Interpretations of the innovation requirement

Innovation is partly defined in WR4 and WR5; however, there are aspects to this definition that would benefit from further refinement.

Firstly, that innovation in GDA is focused on both products and processes. There are different types of innovation including product innovation,[20] process innovation,[21] and business model innovation.[22] GDA has so far focused on product and process innovation. As all GDA AID activities are contracted through the same mechanism—a competitive ITT, run by ESA, with payment for contractual milestones—there is little scope for business model innovation. However, business model innovation is expected to emerge as each consortium reaches the end of its contract and utilises a variety of commercial models for follow-on opportunities.

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18   Manufacturing, launch, and ground control of EO infrastructure.

19   Processing, archiving, and distribution of raw EO data.

20   This focuses on creating a new product, service, or product feature. Examples range from the internet to the pivoting head of Gillette razor blades.

21   This refers to changes made to make a process more efficient. For example, assembly lines were a breakthrough in manufacturing.

22   This is when you transform business operations. Ride-sharing platforms, such as Uber or Lyft, are an example of this. They took the taxi and car service companies' business model and altered it to a peer-to-peer, digitised model. Harvard Business School, 9 Examples of Innovative Products, 23 March 2022, https://online.hbs.edu/blog/post/innovative-product-examples

Whilst process innovation has been acknowledged as equally important as product innovation once activities are launched, the language in the GDA AID SOW has a product/technology orientation: "*latest innovative technologies and methods; e.g., Big Data, Cloud Computing, Artificial Intelligence (AI), Internet of Things (IoT), etc.*" There is a risk that this over-emphasises product innovation over process, particularly during consortium-building pre-contract, when in fact innovation in GDA "*can also be in the programmatic set up instead of the technology. This is the case when we focus on the actual approach to engage with the user, identify his needs and address them in a flexible and agile way. This is especially important when you want to ensure the integration of EO technologies in an IFI project or in their operational processes*" (Alex Chunet, ESA representative to WB).

Secondly, continue to clarify that GDA focuses on "pre-operational" EO Information. The GDA AID SOW requires that *"the EO Information products are encouraged to make full use of the latest innovative technologies and methods."*[23] All EO Information exists on a spectrum of maturity/readiness for use. In the space sector, Technology Readiness Levels[24] are used to define this spectrum, which also applies to EO applications, as Application Readiness Levels (ARLs).[25]

The GDA AID SOWs have a requirement to focus on *"pre-operational developments, as opposed to basic research."* As such, GDA consortia are providing EO Information between ARL 6 and ARL 8, which in summary is testing and user qualification of EO demonstrations within relevant environments to support actual decision-making. The lower ARL levels are research and development (R&D) orientated, and ESA has other programmes better suited to supporting EO R&D. Conversely, ARL 9 is full, repeated operational use, which is a "business as usual" scenario.

The ARL levels would be a useful rubric for the EO Information, clarifying to consortia the expected level of innovation.

> *"GDA would be the wrong mechanism to do basic R&D, there are other programmes in ESA to do that. We should do innovation at a pre-operational level. We should build on existing capabilities and tweak them in an innovative way to make it more fitted and more attractive to the [IFI] audience."*
>
> **Christoph Aubrecht, ESA**

23   GDA SOW

24   ESA, Technology Readiness Levels (TRL), https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/Technology_Readiness_Levels_TRL

25   Lower ARLs (1–3) encompass discovery and feasibility; ARLs 4–6 address development, testing, and validation; and ARLs 7–9 focus on integration of the "application" into an end user's decision-making activity. NASA, The Application Readiness Level Metric, https://www.nasa.gov/sites/default/files/files/ExpandedARLDefinitions4813.pdf

FIGURE 3: Focus of GDA versus Application Readiness Levels

Application readiness level (ARL)

IFI-led capacity building & skills transfer

GDA

More innovative — More adoptable

ESA R&D programmes

Best-fit programme support from ESA & IFIs
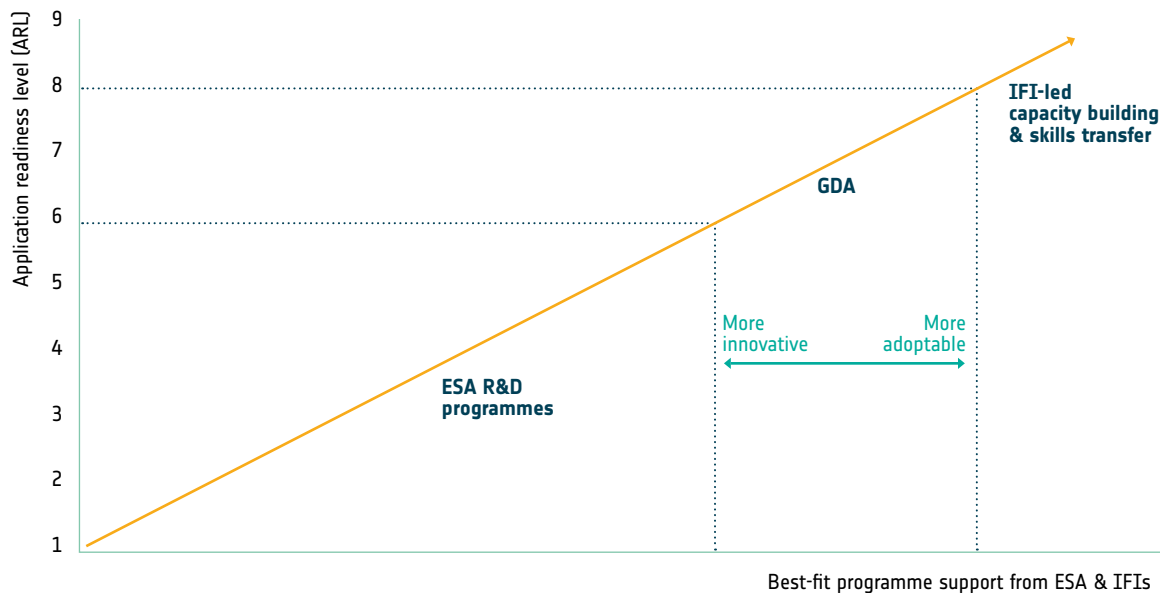
Thirdly, there needs to be a balance between increased innovation with increased costs and risk of failure. Innovation and pushing the state-of-art forward bring inherent risks. New methods in developing EO Information often carry higher costs as they require specialised skills, access to a wider array of both EO (e.g., high resolution) and ancillary data (e.g., social media), and more sophisticated IT infrastructure. As a result, use cases with more innovation embedded may require a greater proportion of the activity budget—and may be at higher risk of failure in innovation. A hypothesis on how a particular methodology will work might be incorrect or difficult to validate within the time and cost constraints of each GDA AID activity.

Balancing the need for innovation with user needs from IFIs and CSs

Whilst there is a requirement from ESA for innovation, consortia must strike a balance with the IFI teams involved—who are often seeking more immediate, adoptable "quick wins." This innovation push de-risks the use of EO Information for cases where IFIs may not be ready to invest themselves without proven results. However, there may be cases where less innovative, more off-the-shelf EO Information might still fit the needs of the IFI and be more appropriate for an IFI programme's often urgent timelines.

> *"I think that we always try to tell our consortia that they need to first of all listen to the needs and requirements that the bank teams express. And then they should try to adjust their solutions to address that need in alignment with advancing EO capabilities."*
>
> **Christoph Aubrecht, ESA**

> "We are committed to innovate but I think sometimes this is not what users want, especially if they have to fulfil some [urgent] duties. If they have to provide the Marine Spatial Planning for the next spring, they are not interested in innovation. It is up to us to understand how innovation can help in fulfilling users' needs."

Angelo Amodio, Planetek Italia

This is acknowledged in the SOW: "*GDA AID activities shall be designed flexibly to put the changing strategic needs of the IFI stakeholders first, while in parallel continuously assessing technical feasibility of service operationalisation and scrutinising scale-up potential.*" However, there is a tension for consortia in deciding whether innovation or IFI needs take priority.

When assessing IFI needs, it is also important for consortia to be agnostic to the specific technological approach. While the GDA SOW encourages the use of "*innovative technologies and methods; e.g., Big Data, Cloud Computing, Artificial Intelligence (AI), Internet of Things (IoT),*" the priority should be that the methods used to provide the EO Information are fit for purpose for the IFIs' needs—so they are user-demand driven, rather than supplier-technology driven.

> "The demand of the bank is not to use AI necessarily, but it is actually to use AI to solve one of the issues."

Paolo Manunta, ESA representative to ADB

Product innovation is occurring from utilisation of non-EO data, advancement of EO Information products, and sophisticated IT infrastructure

To address an IFI's development challenge, EO data is often combined with non-EO (ancillary) data e.g., social media data. EO data provides an excellent view of the natural and built environment; however, other data sources complement it. For example, social media provides a view of the interactions and sentiments between people, whilst census data provides long-term demographic and economic trends.

In GDA Urban Sustainability, the combination of EO data with ancillary data from census, ground sensors, and economic projections is used to accurately assess urban asset exposure and growth in informal settlements, and plan for transport networks and green spaces.[26] Whilst in GDA Fragility, Conflict & Security, combining EO with social media data provides a near-real-time view of the situation on the ground in conflict areas. IFI projects have also reported the benefits of integrating innovative, non-EO data sources, as they help in "*knowing where these things are popping up more or less in real time. [Which] I think is the more useful, exciting tool for me*" (Paul Prettitore, WB).

GDA consortia are also advancing the state-of-art of EO analytics to make full use of the latest innovative technologies and methods. Examples include using EO to identify subtler aspects of the environment, such as to track and identify the source of sewage in the ocean, assessment of above-ground biomass for next generation Monitoring, Reporting, Verification (MRV) systems for forests, and customising EO Information products for using nature-based solutions (e.g., sand dunes and forests to strengthen disaster resilience). Other examples are seeking to increase the frequency of observations, for example, assessing land use change on a sub-annual basis in a tropical rainforest region by utilising machine learning and AI data reconstruction.

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26   Giulia Costella, David Taverner (Caribou Space), and Gregor Herda (GAF), Satellite Earth Observation to Address Data Gaps in Urban Sustainability, 2022, https://gda.esa.int/story/satellite-earth-observation-to-address-data-gaps-in-urban-sustainability

Further examples of product innovation in GDA are not advancing the EO analytics alone, but instead the innovation is on the IT infrastructure to allow rapid, real-time access to the EO analytics.

Recommendations to support innovation in GDA

Recommendations for ESA

Continue to test and promote innovation within GDA

GDA is an appropriate programme to continue to test and prove EO Information innovations to address development challenges. These could be publicly highlighted via GDA webinars and case studies in the CCC activity.

Clarify SOW expectations on innovation

A new subsection in the GDA AID SOW would clarify what ESA views as "innovation," to be inclusive of both product and process innovation, the recommended ARLs for the EO Information to be developed, and tolerances regarding cost and risk of failure. These aspects can also be discussed at consortia's Kick-Off meetings. All of this should be done acknowledging a natural variance in the level of innovation across thematic areas.

Transparent discussion of balancing innovation and IFI needs

During the consortia Kick-Off meeting and subsequent discussions with TOs, discuss with consortia the need to balance innovation with IFI needs and support ongoing decision-making about prioritisation.

3 Impacts of GDA

This section describes the main outcomes and impacts for IFIs after the first full year of implementing GDA AID activities. The GDA programme is relatively unique within ESA in having a dedicated programmatic activity to carry out M&E. Whereas this activity is commonly undertaken in the development assistance sector, it is rare in the space industry.

The rationale for following a structured approach to M&E is that it will enable ongoing learning and reflection of programme implementation and will facilitate—where necessary—course corrections to be made to deliver the greatest possible impacts through the programme activities.

Our review of the impacts of GDA includes realised changes in stakeholders' awareness of EO capabilities, applications, and impacts, as well as any specific benefits provided by EO Information products to IFI projects or CSs. This section also includes analysis of enablers and barriers that have been faced to date in relation to the uptake and mainstreaming of EO by IFIs to generate impact.

The key evaluation questions addressed in this section are listed below. However, after just over one year of implementation, there are some questions that cannot yet be fully addressed. This will be elaborated further in the subsequent pages.

Awareness: To what extent has GDA improved awareness through Knowledge Development among its targeted stakeholders?

» Did the production of EO Information products enable a better understanding of EO Information and its capabilities, applications, and benefits of its use among target stakeholders?

» Did the production of knowledge-sharing materials in the other GDA activity lines (GDA ABC) enable a better understanding of EO Information, applications, and benefits of its use among target stakeholders? Why or why not?

» Which knowledge-sharing resources were deemed most impactful at generating awareness? Why? With whom?

Value: To what extent have the EO Information products in the GDA programme met the various IFI users' needs?

» In what ways (if any) have the EO Information produced under the GDA programme provided additional or new value to the IFIs' operations?

» Were there any observable commonalities or differences between thematic domains, and/or across EO Information products?

Growth (mainstreaming): Have any of the EO Information products developed under the GDA programme been incorporated into or procured by an IFI programme, or led the IFIs to include other EO Information in their programming or loans?

» Were there any observable commonalities or differences between thematic domains, and/or across EO Information products?

Impact: From the IFI perspective, what is the perceived (or evidenced) impact of using the EO Information produced under the GDA programme? Have any benefits been observed relating to:

1 Increased efficiency of existing operations and activities;

2 Improved policy definition and planning;

3 Improved transparency, responsibility, and accountability;

4 New and extended capabilities to address development challenges;

5 Socio-economic impact in client countries; and/or

6 Support growth in the digital economy?

IFI motivations to engage with GDA

From the perspective of the IFIs, the GDA programme offers an unparalleled opportunity to provide customised and world-leading EO Information to operational teams to ensure that both IFI and CS government decision-making is supported by the best possible information. The IFI staff highlighted several motivations for deciding to engage with GDA:

Access to high quality expertise and technology

According to IFI stakeholders and ESA staff, a primary rationale to collaborate with ESA is that GDA offers them access to cutting-edge and high-quality EO information products to support decision-making. This EO Information is considered to be more complex than that which might be available through internal WB or ADB teams such as the GeoLab (in the WB). It was also mentioned that, through the GDA, ESA "de-risks" the opportunity to use EO technology for IFI teams that may otherwise not be ready to invest in those products themselves.

Champions from the EO4SD programme

Another motivation for IFI staff to engage with GDA has been because of a positive experience with GDA's precursor programme, EO4SD. In several cases, IFI staff that were involved in the EO4SD initiative have been important "champions" for the GDA programme, with many stating that they were keen to continue with the type of collaboration they experienced previously. This has the added advantage of enabling the consortia to work with people with an existing "base level" of awareness and experience, rather than needing to start "from scratch":

"Working under the EO4SD exposed me to communicating with a different audience … working with such a company [an EO service provider] …. I particularly enjoyed the brainstorming over several months, all the interactions we had to help them frame the question we had and to work on tools tailored to our needs. So of course, I was excited to engage with GDA in view of similar interactions with those service providers."

Bertrand Murguet, World Bank

"Free-of-charge" products

Another stated reason for the IFIs' collaboration with ESA was the fact that the GDA programme enables project teams to access EO Information "free of charge." However, in GDA there is an expectation that the IFIs will make available complementary financing to ensure that the EO Information is accompanied by capacity building and skills transfer to maximise the potential for its full operationalisation into IFI activities. Therefore, there is an intention to move away from this conceptualisation of the programme as "funded R&D."

Feedback suggests that GDA and its focus on IFI cooperation and operationalisation have not been fully appreciated by all the IFI stakeholders involved. A possible reason for this is that the capacity-building and skills transfer activities have not yet fully begun, and Trust Funds such as the Digital Earth Partnership (DEP) are still being established and have not yet initiated many activities. It has therefore been difficult to secure the aligned financing and resources from the IFI teams in the first year of the programme. However, the understanding and articulation of the intended benefits of the cooperation with ESA will be important to track over the course of GDA to see whether attitudes and expectations shift as more complementary activities unfold.

This topic will be explored further in the Space for IDA Review Year 1 (forthcoming in 2023).

IFI awareness

GDA aims to mainstream the use of EO in development operations. The aims of ESA's collaboration with the IFIs (see the GDA Theory of Change) are to raise awareness of the potential for EO in various IFI thematic areas, to demonstrate how EO Information can meet stakeholder needs and offer value to development operations, and then to scale up the use of these products across the IFIs' portfolios and to generate positive impacts for IFIs and their CS governments.

At this early stage of GDA, most consortia have had limited contact with IFI projects.[27] There has not yet been any activity under the GDA ABC or GDA CCC contracts, both of which will be generating knowledge-sharing materials and communications to enhance broader awareness of GDA and EO across the IFIs. Therefore, this assessment of any changes in IFI awareness is based purely on the activities of the GDA AID knowledge developments and the interactions between those consortia and their IFI points of contact.

Key findings

Existing levels of experience and expertise with EO specifically (and geospatial and remote sensing generally) vary within IFIs and are lower within CSs. However, there has been growth in awareness over recent years—in part attributed to the Covid-19 pandemic, which caused a shift in interest in and awareness of remote sensing technologies.

GDA has helped advance this process by engaging with IFI staff on the potential use cases of EO, the ability to customise solutions, understanding of jargon and technical knowledge, and the ways EO can be applied to specific thematic activities. This has mainly been achieved through the initial engagements held by ESA staff with IFI projects to gauge interest in participating in GDA, and the user requirements gathering process that GDA AID activities have undertaken.

Existing experience and expertise

Varying levels of existing experience and expertise within the IFIs

There is a sense that, in many IFI domains, there is a good basic level of awareness of EO, which has been gradually increasing over recent years. However, there is still a high degree of variation among IFI staff with reports that there are some pockets of each organisation where people have limited understanding of EO. This was mentioned in particular in climate screening, where the use of historic data to analyse locations over a time series is not yet commonplace within the WB and the ADB— despite the widespread use of EO for climate events within the sector.

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27   Of seven GDA activities, five have begun work with 32 IFI projects, a total of six are developing ideas with a further 24 projects, and one activity has only just kicked off.

In ADB, there are "very few" staff who have the specialist technical skills to take the EO data and to do the processing or analytics themselves. Many staff "*are probably familiar with the topic at concept level, but not at a detailed technical processing level*" (Xueliang Cai, ADB). However, in the ADB, as there is already a tendency to use consultants for more specialist work, this level of awareness enables staff to hire personnel with the right expertise for what they need.

In both organisations, the skills required to use EO data were considered to be a little stronger among younger staff members, some of whom have acquired these skills as part of their education. In the WB, the Young Professionals Programme was mentioned as a particularly strong source of people with a core of geography skills. The increasing number of commercial relationships with satellite industry vendors and the IFIs is reported to have led to an improved familiarity with EO. Covid-19 was also mentioned to have played an important role in bringing satellite data to the attention of many IFI staff.

Lower levels of awareness and expertise within CS governments

In contrast to the IFI organisations, it was reported that the "baseline" of awareness and expertise with using EO within CS governments is lower, with a few exceptions where countries have more common usage of EO in the defence and security sector. The Covid-19 pandemic and the shift away from in-person meetings and in-country missions has had some effect on the level of awareness of and receptiveness to using EO data. In general, whereas some had considered EO to be highly technical, more clients are realising that there is free data readily available and have started to request it. However, "*there are still lots of places where we go, where we have to say, this is what we mean by EO, this is what satellite is, and what does resolution mean*" (Benjamin Stewart, WB).

Observed changes in levels of awareness

Over the first year of GDA AID activities, all consortia leads reported that they had witnessed an increase in the level of awareness of EO capabilities in both IFI staff and CS government counterparts. The changes in awareness are mainly related to changes in awareness of what is on offer (potential), the ability to customise solutions, understanding of jargon and technical knowledge, and the ways EO can be applied to thematic activities.

General potential: Access to the cutting-edge and high-quality EO Information that is on offer through the GDA programme has broadened horizons among IFI staff about the types of EO Information that they can have access to, and they benefit from having bespoke EO Information provided to them.

Ability to customise: It was reported by the Disaster Resilience activity that IFI project teams and CSs had become more aware of how EO can be highly customised to specific needs, particularly when compared with the global data layers from free and open sources that they were perhaps more familiar with at the programme's outset.

"Stakeholders and users understand better that EO can be customised for their needs specifically. In general, they initially considered EO data like an input that is gathered, generally without a cost, and used as is. During the first cycle they started to realise that this information can be fine-tuned exactly to meet their needs."

Alberto Lorenzo, Indra

Language: Some IFI staff reported having to spend a lot of time with technical partners to understand terminology and "jargon." Many people credit the ESA representatives as having played a significant role in increasing this awareness.

"We need to find the middle ground between the remote sensing 'geeks' who often come from science and the high-level journalist type of people who don't really understand the technical aspects and limitations."

Zoltan Bartalis, ESA

» **Thematic application:** Across all domains, as the user requirements gathering process has progressed and technology development has begun, some stakeholders started to ask more detailed technical questions, demonstrating a heightened confidence with the technology and a better understanding of its capabilities. Industry partners have used demonstrations and several real project examples to highlight the types of applications that can be developed to meet their needs and to inspire them to think about what is most relevant for their needs.

For the industry partners, GDA also represents an ideal opportunity to engage with IFI staff and to make them aware of other capabilities, even beyond the scope of their GDA AID activity. In that sense, GDA is a marketing and promotion opportunity as well as an educational/awareness-raising opportunity for staff.

Modes and methods that supported changes in awareness

At this stage of GDA, there have been two main activities that have helped to raise awareness of EO. The first has been the work carried out by ESA and its representatives to raise awareness within the IFIs of GDA and to promote it to IFI teams to identify potential collaborators for each GDA AID activity. According to one ADB project lead, knowledge-sharing seminars about GDA have been very well attended, and many staff and consultants have been interested to know more about the programme and to learn more about EO and how it could be used in their projects.

Second, within each given thematic area, the user requirements gathering process, which has been facilitated by the ESA representatives, has given the consortia the opportunity to promote EO use cases in general, and their own EO Information to the decision-makers within the IFIs and to their counterparts within the CS governments and authorities. In some cases, the consortia members have noticed that their IFI counterparts have started to ask more questions and to come up with their own ideas about what kind of information could be generated from the EO data, demonstrating an improved level of understanding about the capabilities.

Recommendations to support GDA to further enhance IFI awareness

Recommendations for ESA

Short introductory training into EO

Among IFI staff, it was suggested that GDA could be better promoted to TTLs to make them aware of the opportunity to collaborate with ESA and the consortia on the knowledge developments, but also to raise their awareness to the potential applications and benefits of EO. TTLs reported that their colleagues may be put off being involved in GDA because they are not familiar with EO and think it will be too difficult to integrate into their programmes. This work may be best suited to the upcoming GDA ABC activity.

> *"I think a lot of people are put off by the lack of understanding of the* [EO] *technology … I think for the purposes of cooperation with the bank and cooperation with TTLs who never have enough time to do much of anything and learning will always become something you want to do but you never really get around to doing. Something really short and snappy would go a long way to at least putting this on people's radar."*
>
> **Paul Prettitore, WB**

Clarify expectations for awareness raising

While raising awareness is relevant for all elements of the GDA programme, the upcoming GDA ABC and CCC activities will play a central role in consolidating information and knowledge from the programme and sharing it more effectively. When these activities Kick-Off, it will be important for them to have a clear understanding of existing levels of awareness across different stakeholder categories and create targeted plans to address and influence awareness with each.

Recommendation for GDA AID consortia

Easy-to-understand promotional materials for non-technical audiences

Similar to the need for simple communications materials during the user requirements gathering phase, various IFI staff suggested that it would be important to ensure that promotion materials about the EO Information would need to be written in easy-to-understand language rather than being too dense or technical for a wider audience. There is a sense that there needs to be more effective communication that is neither too technical nor too simplistic and that more efforts and resources need to be directed towards promotion.

Recommendation for IFI teams

Knowledge-sharing and promotion activities

Some of the IFI project teams mentioned hosting knowledge-sharing events to promote the work carried out under GDA and to raise awareness with other colleagues who might find the EO Information valuable. IFI teams have been thinking creatively about the best format for these knowledge-sharing activities, recognising that many will not dedicate the time to read a long report. For this reason, IFI teams have suggested that they will host a brown bag lunch or draft a one- to two-page brief.

Value creation for IFIs

GDA aims to develop EO Information that can be integrated into IFI projects and that can ultimately meet the needs of CS users. The process of user requirements gathering enables the industry consortium partners to align their EO Information developments with project requirements and to understand how it could add value to CS activities. The value of the EO Information may vary from user to user, but may include:

» **Affordability:** Along with the increase in commercial satellites, there has been an increase in satellites that allow free and open access to data, such as Europe's Copernicus Sentinel missions.

» **Coverage:** Satellites have global coverage that makes it possible to monitor vast, remote, and even conflict regions across countries and continents.

» **Frequency:** The time needed to revisit and acquire data for the same location can be daily or every few days, depending on the satellite and ground infrastructure.

» **Speed:** Increasingly, EO data is available for use just days or even hours after it is acquired, enabling users to receive the EO-derived information they need to act quickly.

» **Continuity:** The coverage of satellites over the same areas means that a time series of data can be created, which allows consistent monitoring of changes of Earth's key characteristics.

» **Impartiality:** Observations are derived from satellite instrument measurements, which have a known and controlled range of error and are thus less susceptible to many of the biases detected in other measures of the same phenomena.

» **Anonymity:** The remoteness of satellites means they can make observations about phenomena on the ground unnoticed, whilst limiting the privacy risks associated with detecting individuals or accessing Personal Identifiable Information (PII).
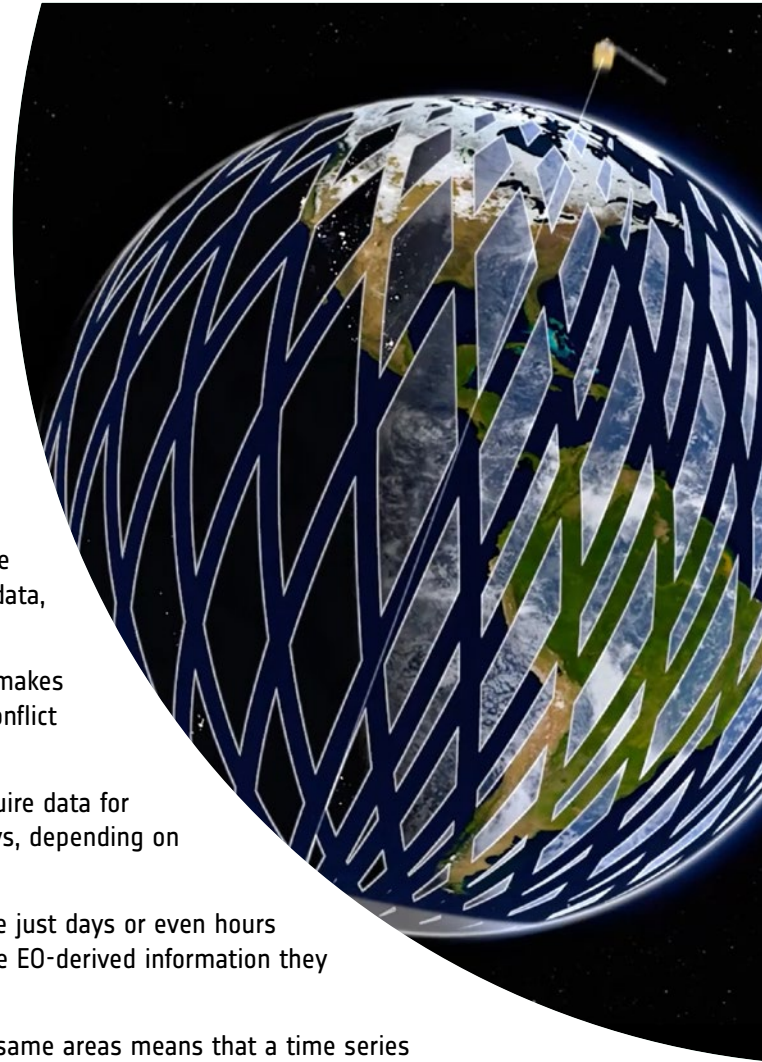
Key findings

At this point in GDA, technology development cycles are still in progress, and only 11 products have been handed over to the user for their feedback.[28] All of these products still have further iterations of development cycles to go through before they are delivered to their CS users for ongoing use. Although there has been limited time for IFI staff to report on examples of value creation for their CS, those staff are optimistic and report that "*there is a lot of enthusiasm*" about the EO Information to be developed. In particular, the continuity and coverage offered by satellite EO have been highlighted as value anticipated by IFIs and CSs.

The challenge that GDA AID will face in the future remains to meet the (at times high) expectations set by IFIs and demonstrate the additional value of their products over existing, off-the-shelf solutions.

IFI and CSs have enthusiasm and aspirations for future value

The GDA AID consortia have gathered feedback about IFIs' enthusiasm and aspirations for the future value of EO to their work. Feedback gathered during the handover of initial iterations of EO Information by the Fragility, Conflict & Security consortium suggests that "*there is a lot of enthusiasm*" about the products developed. For the Disaster Resilience consortium, some products may already be in use by the Nature-Based Solutions team at the WB.[29]

During the user requirements gathering process, many IFI project representatives and CS end users expressed how they anticipate that the EO Information will generate value. For the Sustainable Fodder Management technical assistance project within the ADB in Mongolia, the project lead stated that the client government ministry appreciated the **coverage** of EO data, especially given the lack of other sources of data in the country. In this sense, EO offers information to governments that would otherwise not be available.

> *"For many of our client countries, especially like Mongolia, large countries, but sparse population and very, very limited data connection capabilities that's where … EO comes in strong and can complement many things that we do on the ground and provide us the information that is otherwise impossible or near impossible to collect on the ground."*
>
> **Xueliang Cai, ADB**

From the initial discussions about the potential applications for EO, IFI staff reported that CSs had also been impressed with the **coverage** benefit of EO and are excited about the possibilities to use them.

> *"The Ministry of Territorial Development* [in Georgia] *cannot access about a third of the coast, as it's occupied by Russia since 2008. Geomorphological and hydrogeological phenomena in this area have an impact on the remaining part of the coast, and it is only possible to monitor them through EO, hence they are thrilled."*
>
> **Maria Pia Ancora, ADB**

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28   At the time of writing (December 2022/January 2023), however, another 10+ were in the process of being handed over to IFI teams for a first round of feedback.

29   No team was able to share raw quantitative data on feedback gathered from users at this stage. Therefore, we cannot share more precise insights about the realised value. This is information that we will push to collect in future iterations of the evaluation.

The value of using EO has been highlighted in the Cox's Bazaar Analytics programme, funded by the WB, to get a proxy measurement for economic growth when no other information sources are available. In this situation, there is a desire to be able to understand the impact of the arrival of Rohingya refugees on the local economy. But, given the fast-evolving situation, no robust data exists on the local area before the Rohingya arrived, and so there has been no "baseline" with which to compare the current situation. The value of EO in this case is to be able to use historical data to "travel back in time" to gain a "snapshot" of the local area before the crisis began. The **continuity** of EO data is particularly useful for those projects conducting impact evaluation or change assessment exercises.

Future challenges

In some cases, IFI users have acknowledged that they have high and complex expectations of the value that EO Information created under GDA will provide to them. In the WB's Urban Resilience and Solid Waste Management project, industry partners are currently working towards meeting an operational need with a minimum viable product (even if not the perfect solution) so that they can "start somewhere." However, the ultimate objective is to obtain significantly more value from the EO Information provided, so that they don't only fill an existing gap in information but enhance the project in the future.

Going forward, thematic activities are also faced with the challenge of demonstrating to the IFI stakeholders that their EO Information products are high quality and more accurate than what is available in existing, off-the-shelf solutions. In recent years, there has been a push within the WB to encourage teams to use free and open data and platforms where feasible. Thus GDA consortia need to ensure that they can show their clients that the products that they are developing are highly customised, relevant for their needs, and unavailable from other sources.

> *"Flood mapping, especially in open areas, can be obtained easily even at global level. The improvement of the consortium in this sense has been to provide better confidence levels on these products, and on top, generate flood layers in urban areas, that is a product that is very wanted and not so easily available."*
>
> **Alberto Lorenzo, Indra**

Recommendations to support GDA programme to enhance value creation

Many of the recommendations highlighted in other sections of this evaluation are expected to have an impact on value creation for IFIs and CSs. However, there is one additional recommendation that stands out currently.

Recommendations for GDA M&E

Increase visibility of M&E requirements to better capture data on value

GDA AID consortia have not consistently captured information about the added value proposed or realised by their products for IFIs. Although there is an M&E process in place to encourage this data collection, it has either been too early in the agile development process to implement, or projects began collecting information without consulting guidance from the GDA M&E activity. In the future, the GDA M&E activity should be clearer with consortia (especially those that kicked off before the M&E activity started) about expectations for feedback gathering and classification of value.

Mainstreaming within IFIs

Mainstreaming is the process by which EO Information becomes/is a standard input/approach available for IFI projects. It implies a shift in the use of EO from being only an "innovative" or "disruptive" test case to being integrated in activities and/or plans from the outset. Mainstreaming (as a result of GDA) is considered to have been achieved when:

a   EO is integrated throughout IFI operations and in all phases of the project cycle, resulting in its integration within bank-executed and recipient-executed procurements (including loans and technical assistance).

b   There is further growth/enhancement of the Space for IDA cooperation framework through the mobilisation of aligned activities dedicated to capacity building, skills transfer, and EO Information products on the side of IFIs.

c   There is (qualitative) evidence of GDA AID-developed EO Information being replicated or taken up outside of their initial use cases by the banks.

EO is considered to have been mainstreamed in IFI operations when any of these examples are met.

At this stage of GDA, although some EO4SD activities have led to follow-on CS loans or procurements,[30] it is too early for much of the GDA AID EO Information to have been taken up in this way. Therefore, this analysis will focus mostly on the potential for replication and mainstreaming, as well as any examples where IFIs or CSs have expressed an interest in, or already started planning to, procure EO Information or request loan financing to do so.

Key findings

Over the past ten years, there has been growth in the interest in and use of EO Information within both the WB and ADB. Since the establishment of the GDA programme, there are positive indications that the foundations are being laid for long-term mainstreaming in the future. Most notably, IFI partners have already identified several opportunities where they would be interested in expanding and replicating the EO Information to new geographies. While this growth has been positive, it is not enough to suggest that EO Information has been "mainstreamed" within IFIs.

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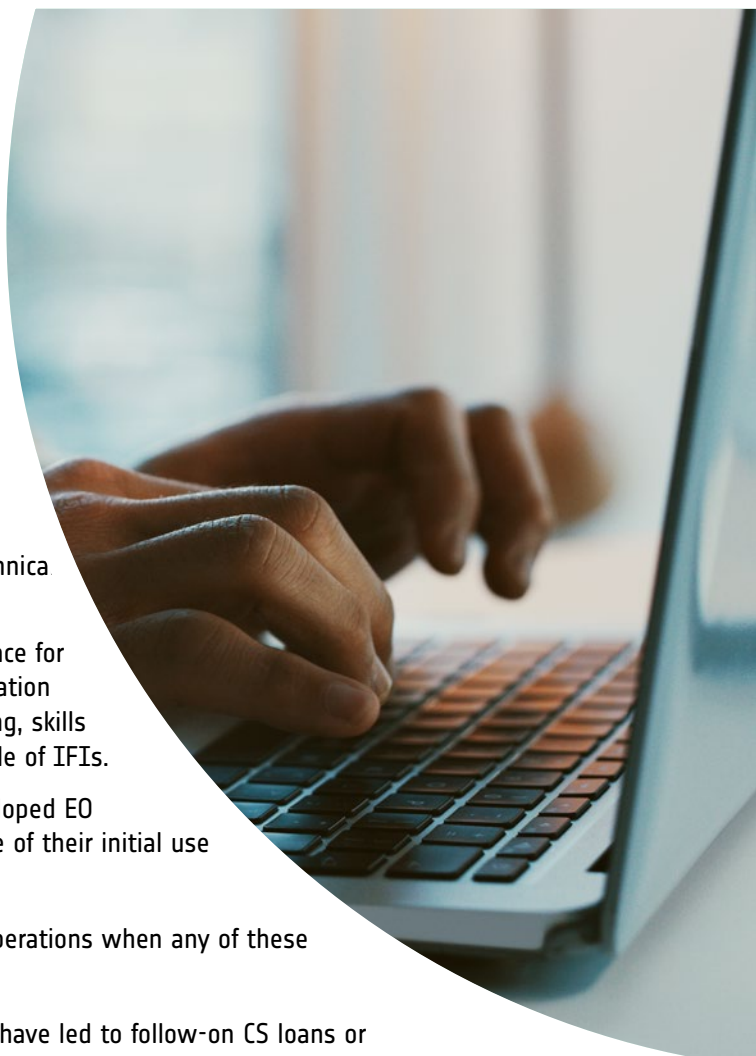
30   One of the consortium members from the EO4SD Fragility cluster—Sistema—developed an analytical platform on the impact of climate change and was asked by ADB to do some follow-up work to analyse the environmental conditions in refugee camps under a new procurement.

There are also several barriers that have been identified that could limit future mainstreaming. These include:

» Costs associated with acquiring EO Information, as engagements shift from fully subsidised to fully paid solutions.

» The potential for costs to spiral as the EO Information requirements grow to add new geographies, use cases, or service platforms—especially if there is no centralised budget holder or decision-maker.

» Limited progress on capacity-building and skills transfer activities to complement GDA, which would enable IFIs to engage more deeply with the EO Information generated.

» Insufficient engagement from senior leadership at IFIs to act as champions for GDA and incentivise staff to take risks on innovative approaches.

» Social barriers, including bureaucratic systems at IFIs, and staff rotations that can disrupt progress.

» Lack of clarity around regulatory and ethical frameworks needed to operationalise EO Information more widely.

» Inadequate spatial data and computing infrastructure to access, process, and interpret EO data within CS and IFI project teams in-country.

While allowing more time for mainstreaming to happen will have a positive impact, several recommendations have been identified to address these barriers and maximise the potential for mainstreaming. These include investing more in and being clear about requirements for capacity building (including where basic product-level training may sit with GDA AID activities), focusing on activities where EO can be used in large scale IFI processes and programmes, supporting broader spatial data infrastructure and institutions in CSs (to maximise benefits), and increasing engagement between GDA and IFI senior leadership.

Recent progress towards mainstreaming

At the start of GDA AID activities in late 2021, the use of EO in the WB and the ADB was already reasonably well established. Interviews conducted by Caribou Space as part of the baseline analysis, called Initial State of Play, under the GDA M&E activity suggested that awareness and acceptance of EO Information has increased significantly over the past ten years.

Many attributed this increase in awareness and acceptance of EO to internal organisational changes (e.g., the creation of the Geospatial Operational Support Team (GOST) within the WB), collaborations and partnerships (including with ESA on the EO4SD initiative), and changes in the sector that have led to greater availability of and accessibility to EO data, either free or at a more affordable price. In addition to this, the past two years have seen a notable increase, as Covid-19 travel restrictions have encouraged staff to look at ways to design, manage, and monitor projects without the need for international travel.

The Initial State of Play analysis identified many procurements of EO data from both the ADB and the WB and found that around 10% of WB projects over the past 20 years mentioned an intention to use geospatial information, including EO data. However, despite this high level of activity on a project-by-project basis, many of our interviews suggested that the use of EO is some way from being fully operationalised or indeed scaled across entire sector portfolios.

FIGURE 4: Proportion of WB Project Documents Mentioning EO-related Keywords with Illustrative Trend Line
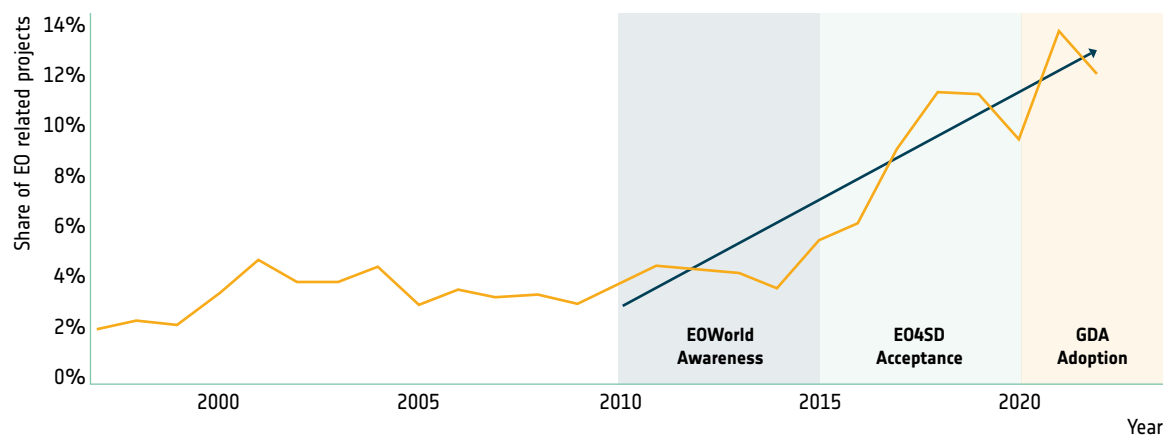
Mainstreaming under GDA

Integration throughout project cycle

According to data reported by the GDA AID thematic activities, five of the six stages of the WB project cycle are being addressed by various GDA EO Information products. The only stage that is not being addressed (yet) is "negotiations and board approval." Although this does not speak to ongoing integration across the IFI project cycle, it does indicate potential for mainstreaming coming out of GDA.

Currently, EO Information appears to be most relevant for the identification, preparation, and implementation and support phases of the project cycle, as indicated in Figure 4.

FIGURE 5: Distribution of EO Products per Thematic Activity and IFI Project Cycle Stage
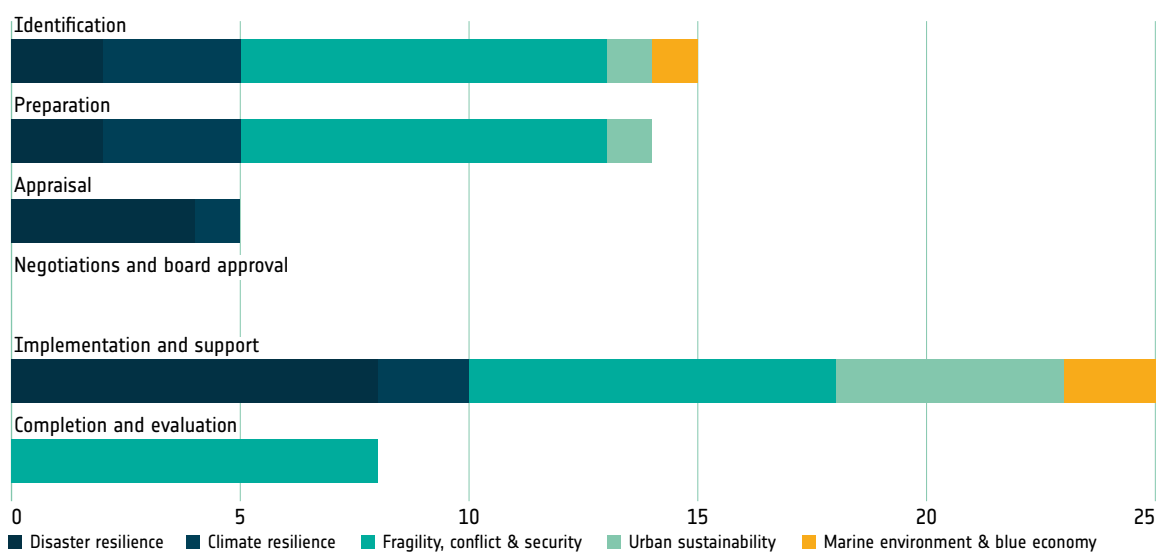
Mobilisation of aligned activities

By establishing a cooperation framework with the IFIs, ESA expects that there will be donor-funded capacity-building and skills transfer activities to complement the knowledge developments of the GDA AID activities. As this grows, it is expected to enhance the Space for IDA collaboration framework—however, the nature and scope of the collaboration will be further explored in the upcoming Space for IDA Review Year 1.

Future implementation of the aligned activities will enable the IFIs to ensure that EO Information is operationalised into project activities and should broaden the level of awareness and capacity across the organisation to spur those products to be replicated or extended to other areas.

IFI partners see many opportunities for EO Information replication

There are several EO Information products being developed that are replicable to other needs in other IFI projects or in other areas of interest (AOI). These have a strong potential to be repurposed and operationalised in new ways, ultimately leading to their mainstreaming across the IFI. The Pakistan Community Support Project (PCSP), for example, is monitoring small-scale infrastructure work in a fragile environment. The IFI team see the EO Information as a prototype that, if successful, could be introduced into the rest of the projects in this part of the WB.

The Nature-Based Solutions (NBS) team is developing a scalable methodology which enables cities to be "scanned" for potential investments that would support disaster risk management or enhanced water resources management. By piloting the use of EO in this methodology with the Disaster Resilience consortium, the NBS team is testing whether this would be a useful data source to apply across the board, thereby replicating the methodology across their portfolio of projects. In this situation, the EO Information is being *integrated into existing work practices* at the WB and would have a clear mechanism for application to several other projects across different thematic areas and in different countries.

This is also the case for the WB's Country Climate and Development Reports (CCDR), diagnostic tools implemented through the Global Program for Disaster Risk Analytics (GPDRA) that help governments prioritise the most impactful actions that can reduce greenhouse gas (GHG) emissions and boost adaptation, while delivering on broader development goals. These diagnostic tools are bespoke but standardised within the WB's internal processes, and therefore the tool itself, with the EO data that it utilises, would eventually have the potential to be *replicated across all the countries* within the WB portfolio. The Disaster Resilience team are supporting a first CCDR to be produced for Azerbaijan but are expecting that similar work may be requested subsequently for India and the Cote d'Ivoire.

For many of the IFI projects currently engaged, their involvement in GDA has been predicated on them being at the right stage of the project implementation, and with the right degree of flexibility to consider and adopt new approaches and new technologies to achieve the intended project outcomes. In the case of the Joint Data Center (JDC), which is experimenting with using EO to analyse settlement patterns and to conduct socio-economic analysis, the Cox's Bazaar area is being used to determine whether this analysis can be done rigorously. If successful, the *approach could be replicated* in other areas where the JDC operates all over the world.

In the Disaster Resilience activity—which was the first GDA AID to Kick-Off in September 2021—there has already been some examples of EO Information being *integrated into working practices* and *additional procurements* because of the interactions between the consortium and IFI project teams.

The World Bank Disaster Risk Financing and Insurance program team in Morocco and the user have received, after several agile cycles, the final EO Information and have requested a further (ESA-funded) development iteration to incorporate some of their feedback. This development is linked to further commercial requests of similar EO Information services by the WB in other countries of North Africa in potential procurements for the GDA consortium.

With the ADB, several companies within the Disaster Resilience consortium have also won new business thanks to its interactions with the IFI teams and their showcasing of the capabilities of EO data.

» Luxembourg Institute of Science and Technology (LIST) and CIMA Research Foundation were commissioned to deliver new EO Information to support the recovery of the floods in Pakistan, funded directly by the ADB.

» Part of the Disaster Resilience consortium (Gisat and ZAMG), alongside other companies that are not involved in their consortium, have been contracted to implement a project for designing an Early Warning in Nepal, with an assessment of the feasibility of using innovative Earth Observation products supported partially by the GDA.

» Planetek Italia won in 2022 a contract with ADB for the provision of access to an EO-based platform that, reinforced by the GDA activities, allows end users to activate and manage sectoral EO-based information services.

Barriers to mainstreaming

At this point in GDA, it is still relatively early to have seen a large volume of mainstreaming activity from the GDA AID activities, as many consortia are still transitioning through their agile technology development process, gathering feedback from their IFI partners, and planning for the first handover of EO Information.

When asked about the potential for operationalising and mainstreaming the EO Information products that are under development, interviewees offered several potential barriers to IFI mainstreaming across the categories of human capacity constraints, technology constraints, and commercial constraints.

Availability of EO data

Under GDA, IFI teams receive EO Information free of charge, on the premise that their organisations will fund relevant capacity building and skills transfer to CSs to facilitate their adoption and operationalisation. ESA TOs and GDA consortia mentioned that this model is difficult, since they may expect to be able to access cutting-edge technologies at little or no cost. While GDA AID activities mentioned the need to share accurate information on ongoing costs with IFIs, it is often not known at the start of engagements, meaning that IFI projects are engaged with very little information about true potential costs of acquiring EO Information products at the scale and sophistication offered in GDA.

It can also be problematic for consortia to invest sizeable time and resources into the development of EO Information, only to realise that the user has no intention of considering a commercial solution after the end of the project period.

> *"Managing changing expectations from the IFIs has also been very challenging for the consortium that has demonstrated great flexibility. We now have several use cases where we can explore different business avenues."*
>
> **Clement Albergel, ESA**

As the costs for use post-GDA become clearer, it is anticipated that this may become a more significant barrier.

Industry sustainability models

The business model of the companies behind many EO Information products presents a challenge for those trying to mainstream the use of EO Information across an IFI's global operations. A large proportion of the current EO downstream market originated in consultancies tackling a very specific issue with a tightly defined scope, using satellite imagery in a specific area of interest. At this level, individual applications and the consultancies providing them have a clear intended user with the means to purchase that application for continued use. However, once these individual applications start to extend in geographical scope and companies start to aggregate services onto a common platform, it can become prohibitively expensive for a single entity to pay for that platform to be delivered and maintained. This piecemeal approach can also make it more difficult to establish the budget holder responsible for it over the longer-term basis. Within decentralised organisations such as the WB and ADB, which operate on a largely country and project level, these kinds of central platforms may be hard to design since both user requirements and budgets are spread across the organisation.

Procurement and licensing

No GDA AID activities have reached the point of actively discussing licensing and restrictions on EO Information (beyond initial discussions of open versus proprietary solutions). It is currently unclear the extent to which this may become a barrier in the future.

IFI and CS capacity and skills

Another significant challenge for mainstreaming the use of EO Information in the IFIs concerns the availability of people with the understanding, capacity, and experience to extract value from the data that is provided. The baseline Initial State of Play analysis of the IFIs indicated that, although there is a good level of awareness of the capabilities of EO across the WB and ADB, there are relatively few staff members who have experience and expertise in using EO, or even broader geospatial data, and even fewer people whose time is dedicated to this kind of analytical work. The WB has a strong staff base of economists and policy professionals, with many staff having additional thematic expertise and/or country-level experience. However, the number of people with background in geography, data science, or analytics is relatively low.

In addition to general staff capacity, the lack of senior leadership involvement in the day-to-day operations of GDA is a potential risk to mainstreaming. Despite the high-level collaboration agreements, there is relatively little senior engagement in the programme at the level of implementing EO developments and complementary activities (as observed by the GDA AID activity teams), meaning that many interactions take place at an individual project level. Having representatives from the IFIs that take responsibility for an entire portfolio of projects across a sector could have an important impact on the level of mainstreaming in the organisation.

A positive example of such a champion is Neeta Pokhrel in the ADB, who is the sector lead for water projects and an enthusiastic promoter of the collaboration with ESA. Having more of these sector leads across both the WB and ADB could be very beneficial for achieving the intended outcomes and impacts of the programme.

Specific capacity building to complement technical developments was incorporated into the responsibilities of each consortium in the precursor programme to GDA, EO4SD.[31] GDA, however, does not include general capacity building as a consortium responsibility—the expectation is that capacity building is funded and led by the IFI as a complementary activity, but to date this has largely not yet occurred.

This has created a risk that product-level training on the EO Information provided by the consortia will not be available (as they have interpreted it to be outside of their scope) or will be provided at varying levels of quality and depth by different consortia, leading to lower adoption.

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31   ESA, Earth Observation for sustainable development, https://eo4sd.esa.int/

Social barriers

A barrier for IFI staff is that both the WB and ADB are relatively bureaucratic organisations, and staff have a heavy workload and work within relatively rigid operating procedures. Many staff whose project teams did get involved in GDA reported that finding the time to engage with new initiatives, new technologies, and particularly new skills can be difficult and can present a barrier for many project leads. There was also a suggestion that organisational incentives are not necessarily set up to promote such diversion from the normal way of working.

An additional complicating factor for the IFIs is that of staff rotation. In the context of GDA, this staff rotation can be problematic if team members are moving during the project, and if the change in personnel leads to a loss of momentum or additional obstacles in getting the EO Information taken up. However, as far as mainstreaming across the organisation is concerned, this staff rotation could be seen in a positive light if those more experienced with EO Information become champions for its use and share that enthusiasm with otherwise less-exposed areas of the organisation.

Beyond these human resource challenges, "social" elements like regulatory and ethical frameworks for accessing and using EO data and data-sharing policies, may not be in place or well known, which could lead to difficulties or challenges when operationalising EO Information over the long term.

Infrastructure constraints

Finally, when it comes to operationalising the EO Information within IFI processes and incorporating them into CS government workflows and decision-making, perhaps the most obvious potential barrier is the technical infrastructure that is required for a user to access, process, and then interpret the data with which they are presented. In some countries where the WB and ADB operate, there is a shortage of computing infrastructure, which means that many staff may lack the desktop/laptop computer to access the products, and there may not be sufficient connectivity to access online platforms.

> *"Maybe we need to spend a bit of time together* [with developing member country governments] *and invest some grant funding to help them understand is it lack of people there, is it lack of funds, is it lack of know-how, is it a lack of policy not allowing them to have something that continues to sustain what we do? And then* [we] *support that before we give other funding."*
>
> **Neeta Pokhrel, ADB**

Recommendations to support GDA mainstreaming

Recommendation for ESA

Capacity building for IFI staff and CSs

The clearest recommendation made by IFI staff was for sufficient training and upskilling to be offered to both IFI teams and CSs to ensure that EO Information can be taken up and operationalised once it is handed over by the consortia. It is important that those developing the EO Information can understand not only the user requirements but also the processes and ways of working within the user's organisation to ensure that they are fully integrated with existing systems and decision-making flows.

Consistent guidance to all consortia on the amount and types of product-level training or handover expected within GDA would be beneficial. This guidance should also be communicated clearly to IFI staff and CS counterparts to ensure that the expectations are clear and any shortfalls in training or capacity can be identified and addressed through the planned aligned financing from the IFIs.

Recommendation for ESA TOs

Integration of EO Information into standard processes and tools within existing IFI procedures

Replicable tools such as the CCDRs or the Nature-Based Solutions methodology are useful channels through which to mainstream the use of EO into existing IFI processes. Identifying these types of standard tools or processes may be an important entry point for further mainstreaming of EO so that these tools and processes are requested again and again by different parts of the IFI structure.

Recommendation for IFIs

Supporting broader spatial data infrastructure and institutions in CSs

To improve mainstreaming across IFIs and CSs, there needs to be greater recognition of the importance of the supporting infrastructure to ensure that users can derive maximum benefit from EO. IFI staff mentioned that this was particularly important for CSs, which need to make parallel investments in capacity, infrastructure, and an institutional "home" for EO Information of the type developed under GDA to ensure that it can be used and sustained beyond the length of the project.

Increase engagement of senior leadership

GDA AID activities often need to work with specialist and technical staff (or consultants) who are responsible for the management and delivery of discrete projects to build appropriate EO Information products. However, to encourage greater participation in GDA from IFIs, unlock the budget needed for complementary activities, and support mainstreaming (through uptake of GDA products and replication/expansion to new geographic areas), the GDA programme would benefit from greater engagement with senior leadership at each IFI, within thematic sectors and regions.

Impact within IFIs and CSs

The longer-term intended impact of the GDA programme is that the uptake and ongoing use of the EO Information developed under the initiative will lead to quantifiable impacts within both IFIs and CSs, including:

» New and extended capabilities

» Efficiency gains

» Enhanced policy definition and planning

» Transparency, responsibility, and accountability

» Socio-economic impact in client countries

» Changes in the digital economy

At this stage in the programme, GDA AID activities have not progressed sufficiently to be able to assess impact of this kind, but the evaluation questions and methods are designed to ensure that it is possible to identify any of these impacts if they should occur in the future.

4 Conclusions

After just over one full year of activities, GDA has made significant achievements. It has launched a collaboration framework with the ADB and WB, created one M&E and seven GDA AID activities, and supported 32 IFI projects or programmes in 40 countries on uses of EO Information to solve development challenges.

While many of these collaborations are still in early stages, they show promising signs that end users are becoming more aware of the potential value and uses of EO Information in their respective areas. Furthermore, there are a small handful of early examples of how EO Information is being used in IFI projects in ways that would begin to indicate mainstreaming. Although there have not yet been any quantifiable impacts on IFIs and CSs in terms of the benefits expected from use of EO, that is not unusual at this early stage in the programme.

Small changes to the approach of GDA, as well as the continued delivery of different activities as planned, will have a positive impact on the programme overall. These include addressing agility and flexibility in how ESA manages activity budgets and deliverables, streamlining communications between consortia and IFIs, and added focus on what handover and future costs may look like to reduce the appearance of GDA as "free technical assistance" to the IFI projects.

In the coming year, the first of the GDA AID activities will begin to draw to a close, and it will be possible to begin to assess the early impacts of these collaborations and EO Information more concretely. At the same time, additional activities (AID and others) will be launched—creating a more comprehensive programmatic approach. Finally, it is anticipated that IFIs will increase their implementation of complementary activities that will benefit GDA and the wider Space for IDA cooperation framework.

To evaluate the ongoing impact of this work, the GDA M&E activity will continue to assess and document results against the GDA Theory of Change through periodic reviews of both the GDA programme and the wider Space for IDA collaboration.

FIGURE 6: Timeline of Future Evaluations of GDA and Space for IDA

JAN 2023	→	MAR 2023	→	DEC 2023	→	DEC 2024	→	TBC 2026
GDA Status Review Year 1		Space for IDA Review Year 1		GDA Mid-Term Evaluation		Updated GDA Status Review Updated Space for IDA Review		TBC — Space for IDA (end of programme) evaluation

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Annex 1: GDA structure

GDA was launched to accelerate impact by fully capitalising on the power of satellite Earth Observation (EO) in international development assistance operations.

The following activities are focused on thematic areas:

» **Agile EO Information Developments (GDA AID)** will provide EO Information in response to requirements identified by IFIs and their CS governments in developing countries. These have launched over late 2021 and 2022. They focus on seven thematic areas (e.g., disaster resilience and agriculture), with four in the planning stage.[32]

The following activities are cross-cutting:

» **Monitoring & Evaluation and Impact Assessment (M&E)** was launched in January 2022 to monitor, evaluate, and report the impact of GDA on development operations.

» **Communicate-Connect-Cooperate (CCC),** otherwise known as GDA CCC Impact Communication, is planned for 2023 and will strengthen the branding, visibility, and impact of GDA through professional strategic communication and visual storytelling.

» **Advancing and Building EO Knowledge and Capacity (ABC)**, also referred to as GDA Knowledge Hub, is planned for 2023 and will define, design, and implement a knowledge hub for GDA.

» **Analytics and Processing Platform (APP)** is planned for 2023 and will produce cross-cutting user-oriented software and analytical tools.

» **Fast EO Co-Financing Facility (FFF)**, planned for 2023, will establish a financing facility to address EO Information developments that are not covered by the existing GDA AIDs, or that are targeting different IFI organisations.

GDA is implemented in partnership with IFIs—WB and ADB—under the joint Space for International Development Assistance (Space for IDA) cooperation framework. Those IFIs are establishing dedicated programmatic structures supporting partnership coordination: the WB Digital Earth Partnership[33] and the ADB EO for Development and Digital Transformation initiative.[34] These IFIs are aligning activities to complement GDA's technical developments, including:

» **Capacity building** for development stakeholders, including IFIs, National Development Agencies (NDAs), and developing country beneficiaries, to put them in a position to use EO Information products and services (produced externally). This can include programmatic support (e.g., group or one-on-one training, or financial support) that comes from an IFI project investment (e.g., training sessions on GDA AID products as part of the GDA contracts are not counted).

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32   ESA, Thematic Areas—GDA AID, https://gda.esa.int/thematic-areas/

33   World Bank Global Facility for Disaster Reduction and Recovery (GFDRR), Digital Earth, www.gfdrr.org/en/digitalearthpartnership

34   ADB, Digital Technology, www.adb.org/what-we-do/sectors/dt/main

» **Skills transfer** of existing European capabilities so that local capacity is established in developing countries to produce and maintain diverse types of EO Information products and services in a reliable and operational way and support local users in their uptake.

FIGURE 7: GDA's Programmatic Structure and Activities
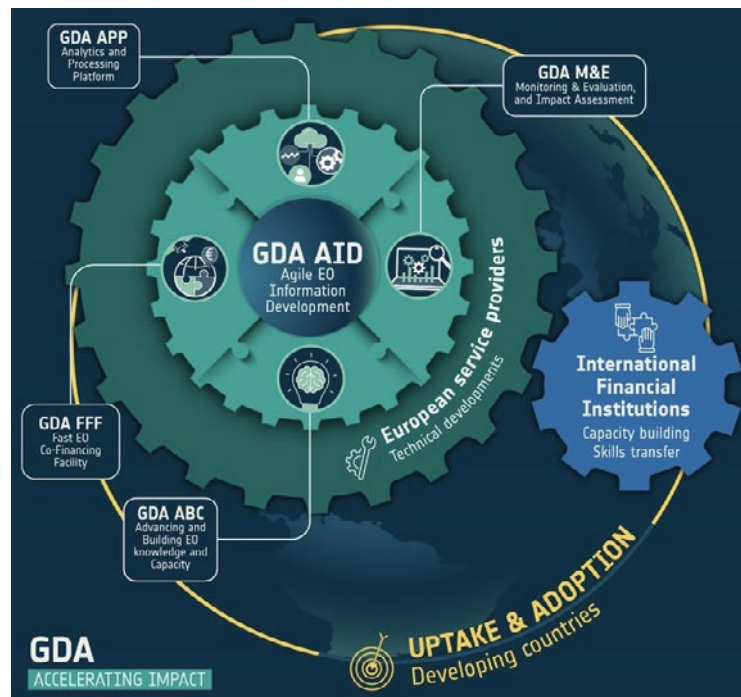
The GDA AID activities provide EO Information in response to requirements identified by IFIs and their CS governments in developing countries. These are led by industry consortia compromised of organisations[35] from 14 Participating States.[36] These consortia are selected via a competitive Invitation to Tender (ITT) process led by ESA. Each consortia then implements their activity within 18 months.[37]

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35   GDA consortia include companies, academia and research institutions, and space agencies.

36   Participating states are Member States of ESA from Europe and Canada that have provided subscriptions to the GDA budget. ESA, Stakeholders, https://gda.esa.int/stakeholders/

37   Timeline extended to 21 months for latest thematic areas.

Annex 2: Evaluation methodology

To assess progress towards the GDA programme objectives and the ultimate impact with critical stakeholders—ESA, GDA consortia, IFIs, and CSs—a measurement approach has been designed that enables all stakeholders to engage with and measure progress throughout the programme to enhance programme responsiveness.

A robust measurement approach also ensures the GDA programme has sufficient data to measure the impact towards the end of 2025.

This measurement approach forms the basis of the methodology for this GDA Status Review. It is based on two core components:

» **GDA programme Theory of Change (ToC)**—To design a measurement approach, the first step was to articulate how/why it is expected that GDA will achieve the anticipated impact. This was defined as the change the programme aims to bring about, the causal chain of events that are expected to bring about that change, the main actors involved, groups who will be impacted, and the conditions required for the intervention to be successful. The GDA ToC has been defined in narrative (written), diagrammatic,[38] and video-based[39] explanations of why the programme activities are expected to produce the outcomes and impacts anticipated. See detail in Annex 3.

» **GDA programme indicators**—As the GDA ToC lays out the "expected story" of the programme in advance, it provides an explicit framework for assessing progress. Thus, the ToC is operationalised by developing indicators that, when measured, will demonstrate levels of progress on various outputs, outcomes, and impacts.

From this, an evaluation framework was developed, including the key evaluation questions:

» **Processes.** Has the GDA programme been implemented effectively and efficiently?
  ○ To what extent has the agile development approach been adhered to? How effective has it been in designing products that meet users' requirements?
  ○ What lessons can be gleaned from implementing the agile development approach?

» **Innovation.** Have the GDA AID EO Information developments been assessed by ESA experts to advance EO state-of-the-art, and in what ways (e.g., accuracy, timeliness, simplicity)?

» **Awareness.** To what extent has GDA improved awareness through Knowledge Development among its targeted stakeholders?
  ○ Did the production of EO Information developments enable a better understanding of EO Information and its capabilities, its applications, and benefits of its use among target stakeholders?

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38   David Taverner and Niamh Barry (Caribou Space), and Christoph Aubrecht (ESA), ESA's GDA programme invests in understanding and generating impact, June 2022, https://gda.esa.int/story/esas-gda-programme-invests-in-understanding-and-generating-impact/

39   David Taverner (Caribou Space) and Ravi Kapur (Imperative Space), VIDEO: GDA Theory of Change, https://gda.esa.int/2022/10/video-gda-theory-of-change/

- Were there any observable commonalities and differences between domains and/or EO Information developments?

- Did the production of knowledge sharing materials in the other GDA activity lines (GDA ABC) enable a better understanding of EO Information, its applications, and benefits of its use among target stakeholders? Why or why not?

- Which knowledge-sharing resources were deemed most impactful at generating awareness? Why? With whom?

» **Value.** To what extent have the EO Information developments produced under the GDA programme met the various IFI users' needs?

- In what ways (if any) have the EO Information produced under the GDA programme provided additional or new value to the IFIs' operations?

- Were there any observable commonalities or differences between thematic domains, and/or across EO Information developments?

» **Growth (mainstreaming).** Have any of the EO Information developments developed under the GDA programme been incorporated into or procured by an IFI programme, or led the IFIs to include other EO Information developments in their programming or loans?

- Were there any observable commonalities or differences between thematic domains, and/or across EO Information developments?

» **Impact.** From the IFI perspective, what is the perceived (or evidenced) impact of using the EO Information produced under the GDA programme?

- Have any benefits been observed relating to: 1) Increased efficiency of existing operations and activities; 2) Improved policy definition and planning; 3) Improved transparency, responsibility, and accountability; 4) New and extended capabilities to address development challenges; 5) Socio-economic impact in client countries; and/or 6) Support growth in the digital economy?

These questions were explored through the following data collection methods:

» **Document reviews.** GDA AID consortia create deliverables within the scope of their contracts with ESA. These deliverables (where available by January 2023) were analysed according to key themes emerging from the evaluation questions. These include, for example, the GDA AID Thematic Sector Information Priorities Report and GDA AID Thematic Sector Final report. Additionally, Caribou Space conducts quarterly reviews with each GDA AID consortium and reviews data provided on by consortia on their measurement of specific metrics (e.g., the status of EO Information products and use cases).

» **Key informant interviews.** To complement ongoing programme monitoring, key informant interviews (KIIs) have been conducted with representatives from WB, ADB, ESA, and the GDA consortia. All interviews were semi-structured and held over Zoom in October and November 2022. A total of 27 individuals were invited for interviews, and 22 were held. Of the 22 completed interviews, five were with GDA consortium leads, eight with ESA staff, three with ADB contact points, and six with WB representatives. All but one of the incomplete interviews were with IFI contact points, who did not reply to email requests to engage. The same data analysis framework (based on the key evaluation questions) was applied to the coding and analysis of these interviews.

Annex 3: GDA Theory of Change

Below is the GDA Theory of Change, an illustration of the impact pathway that could be catalysed by the three-pronged strategy of knowledge development, capacity building, and skills transfer. A video-based version of the Theory of Change is also available.

FIGURE 8: GDA Theory of Change

LONG TERM Collective impact	Operational mainstreaming of EO Information, in partnership with capacity building and skill transfer at scale, will support:				
	Increased efficiency of existing operations & activities	Improved policy definition & planning	Improved transparency, responsibility & accountability	New & extended capabilities to address development challenges	Socio-economic impact in client countries / Support growth in the digital economy

IMPACT Mainstreaming — EO Information is planned & provisioned for in the financial resources & operations of all relevant programme phases of IFI development assistance project

OUTCOME EO production & uptake — IFIs increase their use of EO information within their work practices, promote the use of EO information more broadly and support Client State stakeholders in their uptake

Client State stakeholders **enhance or initiate production & therefore deliver EO Information** in a reliable & operational way

OUTCOMES Advance capabilities and EO value proposition:
- Partner IFIs and Client State stakeholders see a clear value proposition* in using and integrating EO information into their work practices and project cycle [* e.g. on the varied applications, efficiences gains & socio-economic impact]
- IFIs & Client State stakeholders have **sufficient capabilities to use, procure & integrate** EO Information into their programmes cycle &/or work practices
- Client State stakeholders have **enhanced capabilities to produce & deliver** diverse types of EO Information

OUTPUTS EO Information, materials, resources & initiatives produced & accessed:
- **Innovative EO Information** is generated, iterated & delivered to partner IFIs & Client State stakeholders in accordance with their user requirements
- Accessible & relevant **learning & communication materials/resources** are developed for, & accessed by, IFIs & Client State stakeholders
- **Cross-cutting user-oriented software** is developed & accessed by IFI & Client State stakeholders and provides streamlined access to pertinent EO data, relevant to users' workflows
- IFI projects provide relevant, technically appropriate & accessible **capacity building initiatives** that are accessed by IFI teams & Client State stakeholders
- IFI projects **establish skills transfer initiatives** that are accessed by Client State stakeholders to support the growth of local capabilities

Cross-cutting output: Triangular cooperation-between 1) ESA/EO service industry 2) IFI global/regional knowledge units 3) IFI regional/local operations units – support the co-creation of flexible, cost-effective & innovative solutions

CORE ACTIVITIES

Knowledge Development (GDA) | Capacity Building | Skills Transfer
- Develop, test, iterate & demonstrate **new (thematic) EO Information** with partner IFI programmes & projects through GDA AID and GDA FFF consortiums
- Produce a range of **knowledge sharing materials & resources** to communicate the varied capabilities, applications, & benefits of EO information through the GDA CCC and ABC consortia
- Innovate on **'cross-cutting' user-oriented software tools** to link EO-based information to IFI user working processes through the GDA APP consortium
- **Provision of a variety of capacity building / training content & initiatives** to IFIs & Client State stakeholders
- **Establishment of skill transfer initiatives** to support the growth of local capacity in Client States

SPACE FOR IDA PILLARS

Awareness | Acceptance | Adoption

Inequitable access to integrated, affordable, scalable, robust and timely data to support evidence-based policy making and improved service delivery.

GDA

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Explore GDA #AcceleratingImpact at gda.esa.int
Contact us via gda@esa.int