

WORKING PAPER

UNLEASHING THE POWER OF GEOSPATIAL ANALYSIS FOR IMPACT:

THE NEED FOR PRECISE PROJECT GEOLOCATION DATA

FORWARD

As the World Bank Group intensifies its focus on outcomes, knowledge, and accountability, understanding where development interventions take place has become a strategic necessity rather than a technical detail. From the perspective of both, evaluation and data, geography is foundational: everything happens somewhere. Without precise knowledge of project locations, the institution's ability to credibly assess results, manage risks adaptively, and generate actionable learning is fundamentally constrained.

The Independent Evaluation Group (IEG) has been at the forefront of advancing geospatial analysis in evaluation research and practice. Across country, thematic, and project evaluations, IEG has demonstrated that precise project geolocation data is critical for managing for outcomes – enabling deeper insights into impact, equity, and spatial spillovers. Where precise geospatial project data exist, evaluative rigor and learning are strengthened; where they do not, efficiency, accountability, and the credibility of evidence suffer.

These evaluative insights align closely with the World Bank Group's broader data agenda, led by the Development Data Group, which is advancing high quality, interoperable, and policy-relevant data systems through initiatives such as Data360. To gain the proper insights from our investments in data and knowledge, we need better input data from operations—specifically, we need detailed geospatial information on where our projects are and timely updates on their progress. The Geo-Enabling initiative for Monitoring and Supervision (GEMS program) has been widely field-tested and can be scaled to generate the data we need, provided it receives sufficient support from Management.

This paper is therefore especially timely. Under IEG's new Artificial Intelligence strategy, and in close synergy with the Data Group's leadership on data and statistics, there is a shared commitment to promoting the thoughtful and responsible use of AI. Yet, the promise of AI depends critically on the quality of the underlying data, and right now, we are lacking foundational geospatial data on our projects. By advancing systematic, high-quality digital monitoring and georeferencing of operations, as done by the GEMS initiative, the World Bank Group can unlock the full potential of geospatial analysis, AI, and integrated data systems – enhancing transparency, learning, and our ability to deliver results at scale.

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THE ELEVATOR PITCH:

As the World Bank Group sets out to deliver on ambitious targets, become more outcome-oriented, and more efficient, it becomes paramount to know with precision where its projects are located. Yet today this is not the case for most Bank Group operations. At the same time, feasible solutions exist and can be scaled up to bridge this gap. In so doing, we can unleash the power of geospatial analysis for delivering outcomes at scale.

EXECUTIVE SUMMARY

The promise: Precise project geolocation data is critical for the World Bank Group's ability to deliver outcomes at scale, measure its impact, and improve efficiency and risk-management. The Bank Group has the expertise, AI-capability and computational power to unleash the potential of geospatial analysis for operational impact—but it is missing the most important ingredient to do so.

The problem: We currently do not know with sufficient precision where World Bank Group funded projects are. Most projects lack precise location data, often recorded only as broad centroids at project design. This gap hinders our ability to manage, measure, and learn for impact. It is also a source of inefficiencies; teams must engage in lengthy and labor-intensive georeferencing exercises that are prone to error. Leveraging AI tools on poor quality and inaccurate geolocation data is also exposing the Bank Group to significant risks.

The proposal: A reliable centralized geolocation dataset should include accurate GPS coordinates in standard formats, be accessible and regularly updated, and contain metadata for transparency, while respecting privacy and relevance based on project type. To collect this data, the World Bank has already developed a solution in close collaboration with Project Implementation Units, with simple digital tools supported by Bank Group guidelines and quality control. The Geo-Enabling Initiative for Monitoring and Supervision (GEMS) now hosted by DECD has supported over 1,400 projects worldwide. This solution is waiting to be scaled up and institutionalized.

INTRODUCTION

We have convened a group of colleagues across the Bank Group to demonstrate the transformative potential of geospatial analysis and propose solutions to the current gaps.

Over the past ten years, various teams across the Bank Group have experimented with the use of geospatial data, moving beyond research to operational use cases (project and portfolio outcome management, monitoring, evaluation, and learning). Several use cases have been developed with transformational potential in the way that the institution manages outcomes. In addition, the ability to systematically collect high-quality and up-to-date geolocation data is critical to achieve and report on outcomes to the broader indicators and development goals articulated in the Scorecard. Precise project geolocation can provide public sector clients data to drive more transparent and data-informed policy decisions, target budgets, and design more equitable service delivery. It can help private-sector clients create markets and jobs where they are most needed.

However, these teams have run into systemic data gaps. Put simply in most cases, we do not know with precision where the projects we finance are located and often have limited information on the number of project sites. The absence of precise project geolocation data has implications that extend well beyond analytical limitations. It undermines core institutional objectives related to transparency, accountability, and risk management: without clarity on where interventions occur, it is not possible to credibly reach or report on impact, or value for money, nor to identify integrity risks such as fraud or misuse. Moreover, the growing deployment of AI-based tools across the Bank Group depends on the availability of accurate, granular, and spatially explicit development data. In the absence of reliable project location information, the effectiveness of these tools—and the broader capacity to leverage innovation for development impact—is significantly constrained and can expose the Bank Group to significant risks

In this short paper we (1) highlight the critical role played by geospatial data in World Bank Group operations; (2) lay out the current limitations of georeferencing of World Bank operations; (3) define the characteristics of a robust, georeferenced dataset of project locations, and (4) propose a pathway for improving georeferencing at scale.

THE CRITICAL ROLE OF GEOSPATIAL DATA

The use of geospatial data is multifaceted and plays a key role in enabling critical managerial and oversight tasks for the institution and WBG clients. Geography can integrate disparate data from several sources through the foundational principle of location – put simply, everything happens somewhere. Below we highlight a few examples of uses of georeferenced project data across accountability units and for operational support services.

Use in Independent Evaluations

Geospatial data analysis is proving an essential tool for evaluating development projects. It provides the geographic context necessary to monitor project implementation, assess intervention relevance, and quantify social, economic, and environmental impacts. Recent advancements in

geospatial technologies and computational power now enable highly detailed, scalable, and context-sensitive analyses, transforming the way evaluations are conducted.

The Independent Evaluation Group (IEG) has been actively exploring innovative geospatial techniques to enhance evaluation practices. These include the use of Geographic Information Systems (GIS), remote sensing, and computer vision to monitor spatial changes over time and answer key evaluation questions about the relevance and effectiveness of development interventions. Over the past five years, IEG has embedded geospatial analysis in its core products, country program evaluations (e.g., [Mozambique](#) and [Morocco](#)), thematic evaluations (e.g., [demand-side energy efficiency](#) and [Blue Economy](#)), and project evaluations (e.g., [Madagascar and India](#)).

For geospatial analysis to be meaningful in project and portfolio evaluations, it must however be linked to the geographic locations of project implementation sites. Precise geolocation data ensures that analyses are contextually accurate, facilitates the integration of diverse data sources, and strengthens conclusions about project effectiveness and impact. Without precise geolocation, the full potential of geospatial methods in evaluation cannot be realized.

Use for Project Outcome Management and Monitoring across a wide range of contexts

The Geo-Enabling Initiative for Monitoring and Supervision (GEMS) demonstrates how simple, field-tested tools, such as basic smartphones and open-source software can improve project Monitoring & Evaluation (M&E) and supervision, from baseline assessments to impact evaluation, while systematically geo-tagging project sites. GEMS has supported over 1,400 projects in more than 100 countries, across all sectors and wide range of contexts from fragile and conflict-affected to middle-income settings.

GEMS enables remote supervision, improves accountability, and supports adaptive risk management. As it helps collect real-time, location-based data, GEMS also enhances visibility into project activities and outcomes, strengthening decision-making across the project cycle.

Examples, among several hundred others, include mapping over 90,000 schools in DRC, supporting land titling of 1.4 million hectares in the Philippines, and tracking road conditions and resilience upgrades in Bangladesh. GEMS also enables portfolio-level insights: in Ethiopia, Mozambique, Somalia, and Yemen, interactive dashboards link operational data with conflict and displacement trends to inform risk management. GEMS also launched Portfolio Mapping platforms in dozens of countries through which over 650,000 sub-project sites have been mapped at their exact locations and fed into interactive dashboards and web maps, with indicator data and photographic evidence. This enhances the Bank's understanding of its project footprint, enables better portfolio planning, and facilitates development coordination across operations, sectors, and donors.

Use of advanced geospatial analytics in operational support

The World Bank's Geospatial Operations Support Team ([GOST](#)) has been supporting projects through novel geospatial insights for almost a decade. In that time the team has supported projects

across the portfolio, from [energy](#) to [gender](#), looking at issues from [urbanization](#), to [ship tracking](#), to [access to markets](#).

During that time, the team has been constantly required to search through World Bank documents to find project location information, often relying on outdated settlement names and administrative boundaries to map project results. As geospatial data becomes increasingly complex, and increasingly higher resolution, it is frustrating to have to aggregate very fine resolution data to abstract state-level data to match our project descriptions. There is a wealth of data out there that we cannot properly leverage as we don't currently know where our projects are.

Internal Audit Support for Geospatial Knowledge

A FY24Q3 collaboration with GEMs produced a GIA [Quarterly Report Feature](#) highlighting how digital data collection and geospatial tools can enhance accountability and transparency in Bank Group operations. In line with recent efficiency initiatives aimed at faster approvals and streamlined processes, advanced geospatial analytics offer a pathway to quicker insights. Embedding these tools into core operations enables the Bank Group to move with greater speed and agility—delivering results sooner while driving its evolution into a larger, more efficient, and innovative organization.

Use in Integrity Investigations

The Integrity Vice Presidency (INT) has begun to incorporate the use of geospatial imagery in its complaint reviews, investigations and proactive reviews. Many complaints and investigations involve issues with the construction of structures that can often be examined via satellite imagery.

With accurate and complete project location data, integrity reviews could be conducted more efficiently and precisely. It would also enable the integration of geospatial imagery with other datasets to strengthen proactive risk screening and improve the quality of investigative work.

2. CURRENT GAPS IN GEOLOCATION DATA

Currently, the World Bank Group's geolocation data repository for projects¹ is mostly incomplete or inconsistent and not granular enough. Beyond missing entries, the available data is frequently of poor quality. For example, many project sites are recorded only at the country or regional centroid level, lacking the specificity needed to link interventions with observed geospatial changes. In simple terms, it is of little analytical or operational use to only know that a project site is *somewhere* in a large state, district, or county when trying to monitor spatially relevant factors. Moreover, the use of centroid markers can be misleading as they may be interpreted as point locations, although the actual project sites may be hundreds of kilometers away.

¹ <https://dataexplorer.worldbank.org/search/dataset/details?id=72551269-09ff-ed11-8f6e-000d3a32a3d4>, https://geo.worldbank.org/home/explore/projects?status=active&zoomLevel=3&lat_u=4.477856485570586&lng_u=-10.0195310000002&zoom_u=3

Example: The [Azerbaijan Rural Investment Project](#) (AZRIP) provided financing for many different rural investments, too numerous to detail here. When the project was still active, it was listed in the WBG’s geospatial platform as operating in five locations in Azerbaijan, which described the centroids of the 5 states that were being served. However, once the GEMS team trained the local PIU in their project georeferencing methodology, they were able to [map over 2000 project locations](#) within 10 days, with precise geo-tags, details about the investment types, and photographic evidence from the field.

These limitations either preclude the use of geospatial analysis in project monitoring and evaluation or require evaluation teams to manually geocode extensive portfolios of projects—often numbering in the hundreds or thousands—to fill gaps in official institutional data². This process is not only time-consuming, as it involves reviewing multiple project documents (such as PADs, ICRs, and ICRRs), but also highly error-prone due to several challenges. First, inconsistent naming conventions arise when project documents use local or historical names for locations that do not align with current administrative boundaries or official geographic designations. Second, cross-referencing issues occur when some locations referenced in project documents cannot be reliably validated against authoritative geographic databases. Lastly, many project sites are described imprecisely, often using non-standardized references such as natural landmarks (e.g., bays or beaches) or vague descriptors, making it difficult to accurately map these sites to administrative boundaries. Thus, if project sites are not geo-tagged on the ground to begin with, it is often not possible to generate this data at a later stage.

This is made increasingly challenging when attempting to match data and information with the World Bank’s approved national and subnational boundaries, which may be inconsistent with those used by the client government, partner organizations, and other sources of spatial data. Ultimately, back-office and “top-down” geo-locating is no substitute for site-level, ground-truthed, digitally captured GPS coordinates from a reliable source with sufficient access to and knowledge of WBG activities.

Concrete examples of gaps in portfolio geolocation:

- The recent IEG evaluation on Biodiversity contained a portfolio of 136 conservation projects. The identification of the protected areas supported by these projects required a tedious review of project documents through a combination of manual and keyword searches. This was a lengthy process which took several months. The evaluation team was able to extract protected areas from 130 projects, for 526 protected areas. In 25 of the 130 conservation-focused projects that include support to protected areas, it was not possible to identify the names of specific protected areas. Furthermore, in 279 cases (out of 884), we could not match the names of the protected areas as found in the respective project documentation with the World Database of Protected Areas (despite extensive efforts to do so).

² This was attempted in the late 2000s through a collaboration with AidData called Mapping for Results - <https://www.aiddata.org/blog/world-bank-open-data-initiative-features-geo-coded-maps>

- The forthcoming IEG evaluation on Electricity Access in Africa incorporated a geospatial analysis of 61 on-grid electricity projects. To accurately identify the specific grids supported, and in the absence of precise location data, the evaluation team manually georeferenced maps found in project documents. Of the 61 projects, only 36 (59%) included maps with sufficient detail to enable geographic referencing.
- As per August 2025, the GEMS team has been supporting about 30% of the active WB portfolio in over 100 countries. In addition to conducting digital real-time implementation monitoring, these projects have been empowered to collect granular geo-tagged data on their implementation sites through the simple tools and methods promoted by GEMS. In addition, some 300+ projects have participated in the GEMS Portfolio Mapping exercises, mapping over 650,000 sub-project sites. However, these use cases have been demand-driven, because of which, granular geospatial project data is currently not available for about 70% of the active WB portfolio.

3. WHAT IS NEEDED: A RELIABLE, PRECISE GEOLOCATION DATASET

For effective and accountable monitoring of operational activities, risk management, and tracking of outcomes, the World Bank Group, along with its clients and partners, needs to know precisely where their projects are being implemented and to supervise them in real-time. Thus, it is crucial to systematically geo-tag operational activities and leverage geospatial tools (systems and analytics), such as promoted through GEMS, for continuous project monitoring and adaptive risk management. The challenges outlined above highlight the urgent need for a comprehensive, accurate, and standardized geolocation dataset to support effective adaptive management and evaluation practices.

The ideal dataset should: (1) provide accurate GPS coordinates for project sites, using an internationally recognized standard format that supports eventual integration with established frameworks and data repositories (such as IATI), (2) be easily accessible, aggregatable and simple to use, with a clear and consistent structure (e.g., project P-code, sub-project ID, and coordinates), (3) be regularly updated to reflect the evolving nature of project implementation, and (4) include comprehensive metadata that provides context on data updates, data sources, and any assumptions made during data collection to ensure transparency and reliability.

It should be noted that this streamlined approach eliminates the need for the multiple layers of administrative identifiers found in the current dataset, as these can be easily derived from the coordinates (GPS data can simply be aggregated to any administrative area). Furthermore, this ensures consistency: unlike administrative boundaries that may change over time, geolocation coordinates remain constant. As such, this dataset would significantly improve data management while increasing accuracy.

While a standardized geolocation dataset would greatly enhance operational oversight and impact measurement for a large swath of Bank Group operations, it is important to acknowledge that georeferencing may not be relevant for all project types—particularly those focused on governance,

policy reform, or institutional capacity building, where spatial effects are more diffuse, whilst privacy and data protection considerations imply that geo-tags of operations that work at the household level need to be anonymized.

4. TOWARD SYSTEMATIC GEOREFERENCING FOR ENHANCED DEVELOPMENT EFFECTIVENESS: A CALL TO ACTION

To fully leverage geospatial analysis across the World Bank Group (WBG) and uphold institutional commitments to impact, transparency, and accountability, the Bank must prioritize the systematic collection of project geolocation data for all operations with a spatial footprint—including infrastructure, natural resource management, and service delivery.

Achieving this requires reliable, high-quality geospatial data gathered consistently at the project level by PIUs. The GEMS Initiative exemplifies this approach. Through user-friendly, field-appropriate tools, GEMS enables PIUs to: (1) collect precise GPS coordinates of project sites, using integrated digital questionnaires that bundle all relevant project information into a unified data string; (2) regularly update this information throughout the project cycle; and (3) transmit the data to a centralized Bank Group-managed geospatial repository for final quality control. These procedures rely on simple, widely available tools—GPS-enabled smartphones or tablets—and do not require internet connectivity in the field. Data automatically synchronizes once a connection becomes available.

With a modest budget of about USD 3 million, GEMS has already supported around 30% of the active WBG portfolio, demonstrating that large-scale geospatial coverage is feasible at relatively low cost. However, because participation in these exercises is voluntary, current coverage remains partial and does not fully represent the breadth of Bank Group operations or integrate comprehensively with existing operational data repositories. Now hosted in DECD, GEMS is positioned to scale institution-wide, leveraging existing Bank investments such as Data360 and recently developed data quality and metadata guidelines to build a comprehensive, standardized, and reliable geospatial dataset for outcome and risk management, evaluations and learning. To achieve this, DECD will create a fresh initiative entitled GeoME. GeoME will refine what works best from GEMS, expand its analytical capabilities through direct partnerships with GOST, and seek a corporate mandate for digital, georeferenced M&E and Portfolio Mapping data. The latter output will precisely fulfill the ask of this very paper, while the initiative itself will partner with units across the institution to deliver the Bank's new geospatial approach.

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