TC Document

I. Basic Information for TC

▪ Country/Region:	REGIONAL
▪ TC Name:	Fighting Poverty at Continental Scale: Develop AI models to Map Informal Settlements across LAC
▪ TC Number:	RG-T4655
▪ Team Leader/Members:	Menezes Fajardo, Washington (CSD/HUD) Team Leader; Soria Alves, Dalve Alexandre (CSD/HUD) Alternate Team Leader; Chaparro Garzon, Ana Isabel (ITE/IPS); Scetta Maria De Los Angeles (CSD/HUD); Bonilla Merino Arturo Francisco (LEG/SGO); Avila, Francy Dianela (CSD/HUD); Silva Casseb, Marcia Maria (CSD/HUD); Pelaez Enrique Alberto (CSD/HUD); Vazquez Brust Hector Antonio (CSD/HUD); Hernandez Yader Antonio (CSD/HUD); Madera Arends Roberto Jose (CSD/HUD); De Barros Torres Gabriel (CSD/HUD) Bonilla Merino Arturo Francisco (LEG/SGO); Avila, Francy Dianela (CSD/HUD); Silva Casseb, Marcia Maria (CSD/HUD); Pelaez Enrique Alberto (CSD/HUD); Vazquez Brust Hector Antonio (CSD/HUD); Hernandez Yader Antonio (CSD/HUD); Madera Arends Roberto Jose (CSD/HUD); De Barros Torres Gabriel (CSD/HUD); Chaparro Garzon, Ana Isabel (ITE/IPS)
▪ Taxonomy:	Research and Dissemination
▪ Operation Supported by the TC:	.N/A
▪ Date of TC Abstract authorization:	11 Nov 2024.
▪ Beneficiary:	Borrowing member countries in Latin America and the Caribbean
▪ Executing Agency and contact name:	Inter-American Development Bank
▪ Donors providing funding:	OC SDP Window 2 - Economic Growth(W2F)
▪ IDB Funding Requested:	US$200,000.00
▪ Local counterpart funding, if any:	US$0
▪ Disbursement period (which includes Execution period):	24 months
▪ Required start date:	January 2025
▪ Types of consultants:	Firms, Individual Consultants and non-consulting services
▪ Prepared by Unit:	CSD/HUD-Housing & Urban Development
▪ Unit of Disbursement Responsibility:	CSD/HUD-Housing & Urban Development
▪ TC included in Country Strategy (y/n):	No
▪ TC included in CPD (y/n):	No
▪ Alignment to the Update to the Institutional Strategy 2024-2030:	Environmental sustainability; Gender equality; Institutional capacity and rule of law; Productivity and innovation

II. Objectives and Justification of the TC

2.1 **Objective**. This Technical Cooperation (TC) aims to develop a standardized Artificial Intelligence (AI)-based methodology and evaluate its efficacy as a tool for mapping all informal settlements across Latin America and the Caribbean (LAC), assess their climate vulnerability, and guide remediation efforts. By automating the identification of

informal settlements using satellite imagery and neural networks, the project will improve public service delivery and environmental safety, which is crucial to spurring economic growth by improving health, productivity, and overall quality of life in underserved communities. The methodology will be open and standardized, designed to be scaled globally by leveraging advanced AI technologies and insights from similar global initiatives -such as the European Space Agency-funded IDE Atlas project and the United Nations Innovation Technology Accelerator for Cities (UNITAC).

2.2   Justification. This initiative addresses a critical challenge: to count on additional instruments to efficiently identify LAC communities that need public services and safety measures. It also tackles the climate change vulnerability of informal settlements by integrating climate risk data and identifying priority areas for intervention.

2.3   The lack of accurate and efficient tools for identifying underserved communities in LAC has far-reaching consequences. Informal settlements are often absent from official maps and databases so that they can be overlooked in planning and investment decisions, exacerbating poverty, inequality, and health risks. Without visibility on the locations and conditions of these communities, governments and organizations face significant challenges in deploying targeted resources, such as healthcare, education, sanitation, and infrastructure. This TC, through AI-based mapping, aims to close this visibility gap, enabling policymakers to pinpoint vulnerable areas and allocate resources more effectively, which is essential for driving sustainable and inclusive development across LAC.

2.4   Additionally, climate change is intensifying the vulnerability of informal settlements, often located in high-risk zones like floodplains, steep slopes, or areas prone to extreme heat. Traditional approaches to assessing climate vulnerability are resource-intensive and slow to adapt to rapidly changing environmental conditions. By embedding climate risk data directly into the mapping methodology, this project provides a dynamic tool to monitor these vulnerabilities continuously. This enables local governments and agencies to prioritize interventions in areas facing the highest climate risks, thereby safeguarding lives, enhancing resilience, and preventing the loss of critical infrastructure. Identifying these high-risk areas also supports long-term urban planning, helping cities in LAC adapt to the challenges of climate change with proactive, data-driven strategies.

2.5   As AI for territorial planning is an emerging field, this TC is critical for facilitating knowledge sharing and lessons learned across LAC and other regions. Collaboration across international teams is essential for this initiative, as it allows for the pooling of diverse expertise, knowledge, and perspectives critical to the success of a project of this scope and complexity. Different regions and countries have varying expertise in AI, satellite imagery analysis, and climate vulnerability assessment, each bringing unique insights to enhance the methodology's robustness and applicability. This cross-border collaboration facilitates the transfer of advanced technological skills. It supports adopting methodologies to diverse local contexts, ensuring the tool can be fine-tuned to specific regional characteristics and needs.

2.6   Furthermore, leveraging insights from international projects, such as IDEAtlas[1] and UNITAC[2], provide valuable knowledge-sharing opportunities, enabling the team to

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1   The primary objective of IDEAtlas (https://ideatlas.eu/), an ESA-funded project, is to develop, implement, validate, and showcase advanced AI-based methods to automatically map and characterize the spatial

draw on proven approaches and avoid potential pitfalls similar initiatives encounter. By working together, international teams can build a standardized, scalable methodology that reflects global best practices while addressing the unique challenges of LAC. This collaborative approach also positions the project to evolve and expand as technology advances, helping to establish a resilient foundation that can adapt to future technological, environmental, and social developments worldwide.

2.7   Moreover, this TC draws on IDB Cities Lab's expertise in emerging technologies and artificial intelligence. The Cities Lab strives to implement innovative approaches to rethink and address complex urban challenges in LAC cities while better informing future IDB operations. For instance, the Cities Lab developed the Open Urban Planning Toolkit, a collection of open-source applications that support urban planning tasks by leveraging advanced technologies like AI, satellite sensors, and geospatial data processing. This and other experiences establish a solid foundation for creating customized solutions that harness new technological and conceptual advancements.

2.8   The project addresses gender and diversity issues by establishing a cost-effective method to identify the most vulnerable and climate-exposed urban communities in LAC. Locating and understanding the expansion of informal settlements is the first step to improving public service accessibility and climate resilience for underserved communities, which often include diverse and marginalized groups such as women-headed households, ethnic minorities, and other vulnerable populations. Women-headed households represent most of the poorest people living in informal settlements worldwide. A study from the World Bank found that 36% of Indigenous households living in LAC cities—one in every three family units— reside in favelas, low-income neighborhoods, or informal settlements with inadequate conditions and without access to essential services.[3]

2.9   By streamlining the generation and updating of informal settlement data, this TC will directly benefit government agencies working on urban development and housing. Mapping these areas and integrating climate risk data, the project aims to target the specific needs of these communities, which are frequently overlooked in urban planning and resource allocation. This approach fosters a more inclusive urban development model, ensuring diverse populations benefit from improved safety, resilience, and quality of life. In conclusion, this TC will serve as a model of how emerging technologies can be harnessed to address complex social and environmental challenges, setting a foundation for broader regional advancements in sustainable development.

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extent of informal settlements from Earth Observation (EO) data. The project supports national and local governments and civil society in monitoring progress on SDG indicator 11.1.1 on the proportion of the urban population living in informal settlements or inadequate housing.

[2]   The United Nations Innovation Technology Accelerator for Cities (UNITAC, https://unitac.un.org/) is a partnership between the United Nations Human Settlements Programme (UN-Habitat), the United Nations Office for Information and Communication Technology (OICT), and HafenCity University, a German technical university focused on the built environment. UNITAC supports national and local governments with their digital transition, applying a multi-level governance strategy and helping them build skills and capabilities to develop, procure, and effectively use digital technologies ethically and inclusively.

[3]   https://blogs.iadb.org/ciudades-sostenibles/es/poblacion-indigena-y-su-derecho-a-la-ciudad/

2.10 **Strategic Alignment.** This operation is consistent with the IDB Group Institutional Strategy: *Transforming for Scale and Impact* (CA-631) and aligns with the following objectives: (i) addressing climate change by helping cities identify informal settlements and assess their climate vulnerability, thereby enhancing disaster preparedness and climate resilience; (ii) reducing poverty and inequality by improving the visibility of informal settlements and enabling policymakers to provide public services in vulnerable areas; and (iii) bolstering sustainable regional growth by improving the efficiency and targeting of public service delivery, urban planning, and economic inclusion policies.

2.11 The TC is also aligned with the following operational focus areas: (i) biodiversity, natural capital, and climate action, by integrating climate risk data into informality mapping algorithms, thus enabling targeted interventions to improve resilience against climate-related threats; (ii) gender equality and inclusion of diverse population groups, by supporting improved public services and resilience planning for underserved communities, including women-headed households that represent a high proportion of the poorest people living in informal settlements worldwide; (iii) institutional capacity, the rule of law, and citizen security, by easing acquisition of local expertise in AI-based mapping and resilience planning, and guiding efforts to provide equitable public service access in informal settlements; (iv) sustainable, resilient, and inclusive infrastructure by compiling models of comprehensive satellite imagery database specific to informal settlement characteristic; and (v) productive development and innovation, by leveraging AI to automate the identification of informal settlements, a more efficient and scalable method than traditional mapping techniques. This innovation increases productivity by reducing time and human resources requirements and enabling faster response times for public service delivery and urban planning. The activities of this TC are aligned with the pillars and objectives of Window 2 of the Ordinary Capital Strategic Development Program -OC SDP- (GN-2819-14) fund by developing and applying new, multidisciplinary solutions, analytical frameworks that facilitate the implementation of and tools enriched by frameworks/approaches from different social sciences that support policymakers to facilitate growth reforms and agendas in the region.

III. Description of activities/components and budget

3.1 **Component I. AI-based Methodology for Informal Settlement Mapping and Climate Vulnerability Assessment at Scale.** This component aims to develop an AI-based methodology using neural networks and satellite imagery to identify informal settlements automatically. The methodology will also include a climate risk estimation model to overlay vulnerability data (e.g., flood risks, extreme heat) over the informality maps. The system will be designed to facilitate broad use and replication, using open-source technologies and shared standards to promote compatibility with current and future poverty mapping initiatives. A key aspect of its development will be the definition of inclusion and safety guidelines to guide a responsible application of AI algorithms that identify potential gaps and biases related to gender or diversity-related characteristics of local populations. This component will include the following key activities:

3.2 Data collection and preparation, such as curating a comprehensive satellite imagery database specific to informal settlement characteristics across diverse regions in LAC. This will involve securing high-resolution satellite data sources and engaging with

subject experts on urban informality to ensure accurate data labeling and contextual understanding of informal settlements.

3.3   The development of a methodology to apply state-of-the-art, open-source AI algorithms to process satellite imagery and automate the identification of informal settlements. This will involve training models to detect key physical features in informal areas, such as building density, construction type, and land use patterns. The methodology will prioritize using code libraries and data sources compatible with existing AI-based mapping efforts to ensure compatibility with and facilitate collaboration between projects mapping urban informality anywhere in the world.

3.4   Overlay climate risk data (floods, heatwaves) onto the informal settlement maps, enabling the visualization and analysis of these settlements' exposure to extreme climate events.

3.5   This component's main outputs will be a validated data repository, an AI methodology for informal settlement mapping, and a set of publicly available AI-training-ready datasets that will support other stakeholders' replication and enhancement of the methodology.

3.6   **Component II: Methodology Deployment and Validation.** This component aims to test the methodology's effectiveness in real-world conditions, gather insights and best practices, and refine the approach for broader application. To achieve this objective, the team will deploy and validate the AI-based methodology for informal settlement mapping and climate vulnerability assessment in a specific territory. By implementing the methodology in a selected country's urban areas, this project will evaluate its performance and identify areas for improvement, creating a transferable model adaptable to other countries with similar needs.

3.7   To complement the deployment and validation efforts, this component will incorporate iterative feedback sessions with local urban planning specialists and other stakeholders[4]. These sessions will serve as checkpoints to assess the methodology's relevance, usability, and impact on local planning needs while refining the model to account for specific regional factors such as climate nuances or social dynamics. An additional output will be a detailed validation report documenting the model's performance, user feedback, and implementation challenges, which will serve as a reference for adapting the methodology to other LAC countries.

3.8   The pilot country will be selected during the TC implementation, using the following selection criteria: (i) track record in working with AI tools; (ii) technical capacities and political will to apply these types of methodologies; and (iii) possibilities for synergies with HUD operations and previous IDB Cities Lab work. The required authorizations will be secured before initiating pilot projects in any IDB member country.

3.9   **Component III: Knowledge Sharing and Dissemination.** This component will foster international collaboration and knowledge exchange among experts working on AI-based informality mapping. A core activity will be convening a global symposium that brings together researchers and practitioners from leading AI initiatives—such as UNITAC, the IDE Atlas, and regional projects in Africa and Asia. The symposium will focus on sharing insights, challenges, and technical advancements, aligning methodologies, and establishing a coalition of experts dedicated to refining and scaling

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[4] Once the country where these activities will take place is selected, HUD will request a non-objection letter from the corresponding authorities.

AI applications for informal settlement mapping worldwide with IDB's Housing and Urban Development Division (CSD/HUD) acting as the leading promoter for the LAC region. This component will also generate a knowledge product that will explain the methodology and its application, describe the inclusion and safety guidelines intended to minimize gaps and biases related to gender or diversity issues, and draw insights from the lessons learned from its deployment in a real-world scenario.

3.10 Additionally, this TC will promote creating an international working group and collaboration platform to facilitate ongoing knowledge exchange, joint problem-solving, and sharing of open-source tools and datasets, creating a consortium for future coordinated initiatives. Participating institutions will share and make publicly available resources such as guidelines, case studies, open data, and open algorithms, fostering long-term partnerships and innovation across borders.

3.11 The total budget for this TC is USS$200,000, financed by the IDB through the Economic Growth Initiative (OC-SDP). No local counterpart contributions are expected (nor in kind or cash).

Indicative Budget

Activity/ Component	Description	IDB/Fund Funding	Total Funding
Component I. AI-based Methodology for Informal Settlement Mapping and Climate Vulnerability Assessment at Scale	Research activities, the definition of requirements for interoperable AI-based mapping and climate risk evaluation, and coordination with worldwide experts to agree on shared technical standards and data processing methods	US$35,000.00	US$35,000.00
	AI mapping algorithms and Climate Risk Assessment framework development (technical design, programming, testing, documentation).	US$40,000.00	US$40,000.00
Component II. Methodology Deployment and Validation	Apply the methodology to a selected country's main urban area(s), fine-tune the algorithm to improve its output based on stakeholder feedback, and report results, lessons learned, and recommendations.	US$50,000.00	US$50,000.00
Component III. Capacity Building and Dissemination	Conference on AI for addressing urban poverty	US$50,000.00	US$50,000.00
	Knowledge exchange activities and publication	US$25,000.00	US$25,000.00
Total		US$200,000.00	US$200,000.00

3.12 The team leader will supervise and execute this TC and work closely with IDB's Country Offices and their contacts in cities participating in its activities. Disbursements will be made from IDB Headquarters with the support of IDB's Administrative Services and Corporate Procurement Division.

3.13 The project team leader will monitor the TC according to the approved budget.

IV. Executing agency and execution structure (estimated length: 1 page)

4.1 The Bank will be the Executing Agency through CSD/HUD, responsible for the technical supervision and administration of the TC's activities, which requires consensus and coordination among multiple entities from the public, private, and civil society sectors. The Bank, as a neutral actor, has the potential to promote dialogue and facilitate agreements. CSD/HUD will leverage the experience that the Cities Lab has developed across LAC regarding AI applications for planning. Activities will be executed jointly with the IDB's Country Offices and their contacts in participating cities, and a non-objection will be obtained before the design and execution stage.

4.2 All activities to be executed under this TC have been included in the Procurement Plan (Annex IV) and will be contracted in accordance with Bank policies as follows: (a) Complementary Workforce (AM-650) for Individual consultants; and (b) Corporate Procurement Policy (GN-2303-33) and its associated guidelines for Services provided by firms.

4.3 The execution by the Bank of this TC is justified because it will require a centralized implementation of complex activities and procurement, with limited technical and institutional capacities to execute the project during the projected time frame. Therefore, the Bank's capacity and experience to execute complex projects in multiple agencies (local or national) will be critical for the project's implementation. In addition, CSD/HUD and its Cities LAB have substantial experience in providing technical assistance, particularly in housing, urban planning, sustainability, AI in urban areas, and topics related to the activities financed under this TC. The Cities LAB will also engage with external AI, urban development, and remote sensing experts, including teams from the United Nations Innovation Technology Accelerator for Cities (UNITAC) and leading academic labs. Moreover, AI for territorial planning is an emerging topic, and a Bank execution would facilitate knowledge sharing and lessons learned between the LAC region. Additionally, the Bank's implementation will give a deeper insight into potential opportunities in incorporating satellite and AI-driven solutions in current and future projects in LAC.

V. Major issues

5.1 Five main risks have been identified: (i) the coordination complexity due to the need to engage multiple stakeholders, which could create delays; (ii) the lack of technical capacity in local governments to validate AI-based solutions; (iii) the lack of commitment from local governments to support the validation of the methodology; (iv) limited availability of historical climate data which could affect the accuracy of risk models; and (v) artificial intelligence is a rapidly evolving field, meaning that some aspects may not work as expected.

5.2 To mitigate coordination complexity, the Cities Lab will engage with a reduced network of experienced partners and use the IDB's local networks to facilitate the methodology's deployment and evaluation. To address local governments' lack of technical capacity, capacity-building efforts -including hands-on sessions- will be in scope for the deployment and evaluation phase. Local governments' potential lack of commitment will be mitigated by aligning activities with ongoing urban planning initiatives and involving relevant stakeholders. To reduce potential drawbacks from the lack of historical climate data, the project will prioritize assessing threats that can be measured with readily available satellite data, such as flooding or heat island effect,

and partner with subject-matter experts. Finally, to adapt to the rapid development of AI technologies we will: use standardized AI APIs and frameworks to facilitate compatibility with new tools and techniques; use open and widely supported data formats to ensure compatibility with future tools and technologies, and foster active community engagement, building a global community of contributors who can suggest and implement updates as technology evolves.

VI.   Exceptions to Bank policy

6.1   There are no exceptions to Bank policy.

VII.   Environmental and Social Aspects

7.1   This Technical Cooperation is not intended to finance pre-feasibility or feasibility studies of specific investment projects or environmental and social studies associated with them; therefore, this TC does not have applicable requirements of the Bank's Environmental and Social Policy Framework (ESPF).

Required Annexes:

Results Matrix_49985.pdf

Terms of Reference_10099.pdf

Procurement Plan_51684.pdf