

## TC Document

### Decarbonization Pathways for the Heavy Industry in LAC RG-T3918

#### I. Basic Information for TC

▪ Country/Region:	REGIONAL
▪ TC Name:	Decarbonization Pathways for Heavy Industry in the LAC Region
▪ TC Number:	RG-T3918
▪ Team Leader/Members:	Gischler Blanco, Christiaan (INE/INE) Team Leader; Almeida Oleas, Natalia (LEG/SGO); Bonzi Teixeira, Augusto Cesar (INE/ENE); Brakarz, Barbara (CSD/CCS); Braly-Cartillier, Isabelle Frederique (IFD/CMF); Brusatin Cadavid, Nicola (INE/INE); Echevarria Barbero, Carlos Jose (INE/ENE); Garcia Fernandez, Javier (INE/INE); Juarez Olvera, Mariel (CSD/CCS); Leal Rosillo, Roberto (VPS/ESG); Lopez Solana, Fatima Alejandra (CSD/CCS); Maia Ribeiro, Karisa (INE/TSP); Netto De A. C. Schneider, Maria E. (IFD/CMF); Ramirez Ramirez, Gmelina Juliana (CSD/CCS); Riobo Patino, Jairo Alexander (INE/TSP); Sucre Pantin, Carlos Gustavo (INE/INE); Urteaga Dufour, Jose Antonio (INE/ENE) Oleas, Natalia (LEG/SGO); Bonzi Teixeira, Augusto Cesar (INE/ENE); Brakarz, Barbara (CSD/CCS); Braly-Cartillier, Isabelle Frederique (IFD/CMF); Brusatin Cadavid, Nicola (INE/INE); Echevarria Barbero, Carlos Jose (INE/ENE); Garcia Fernandez, Javier (INE/INE); Juarez Olvera, Mariel (CSD/CCS); Leal Rosillo, Roberto (VPS/ESG); Lopez Solana, Fatima Alejandra (CSD/CCS); Maia Ribeiro, Karisa (INE/TSP); Netto De A. C. Schneider, Maria E. (IFD/CMF); Ramirez Ramirez, Gmelina Juliana (CSD/CCS); Riobo Patino, Jairo Alexander (INE/TSP); Sucre Pantin, Carlos Gustavo (INE/INE); Urteaga Dufour, Jose Antonio (INE/ENE) Oleas, Natalia (LEG/SGO); Bonzi Teixeira, Augusto Cesar (INE/ENE); Brakarz, Barbara (CSD/CCS); Braly-Cartillier, Isabelle Frederique (IFD/CMF); Brusatin Cadavid, Nicola (INE/INE); Echevarria Barbero, Carlos Jose (INE/ENE); Garcia Fernandez, Javier (INE/INE); Juarez Olvera, Mariel (CSD/CCS); Leal Rosillo, Roberto (VPS/ESG); Lopez Solana, Fatima Alejandra (CSD/CCS); Maia Ribeiro, Karisa (INE/TSP); Netto De A. C. Schneider, Maria E. (IFD/CMF); Ramirez Ramirez, Gmelina Juliana (CSD/CCS); Riobo Patino, Jairo Alexander (INE/TSP); Sucre Pantin, Carlos Gustavo (INE/INE); Urteaga Dufour, Jose Antonio (INE/ENE)
▪ Indicate if: Operational Support, Client Support, or Research & Dissemination:	Client Support
▪ Operation Supported by the TC:	.
▪ Date of TC Abstract authorization:	29 Jun 2021.
▪ Beneficiary (countries or entities which are the recipient of the technical assistance):	Regional: Trinidad & Tobago, Mexico, Brazil
▪ Executing Agency and contact name:	Inter-American Development Bank

▪ Donors providing funding:	OC Strategic Development Program for Infrastructure(INF)
▪ IDB Funding Requested:	US\$200,000.00
▪ Local counterpart funding, if any:	US\$0
▪ Disbursement period (which includes Execution period):	36 Months
▪ Required start date:	12-01-2021
▪ Types of consultants:	Firms
▪ Prepared by Unit:	INE/ENE-Energy
▪ Unit of Disbursement Responsibility:	INE/ENE-Energy
▪ TC included in Country Strategy (y/n):	Y
▪ TC included in CPD (y/n):	N
▪ Alignment to the Update to the Institutional Strategy 2010-2023:	Environmental sustainability; Productivity and innovation

## II. Objectives and Justification of the TC

2.1 The general objective of this TC is to assess pathways for the decarbonization of the heavy industry, including cement, steel, and chemical among others in Latin-America and the Caribbean (LAC). First efforts will focus on Trinidad and Tobago, Mexico, and Brazil. Specific objectives are (i) to assess and propose an array of technologies that will contribute to the decarbonization pathway for heavy industry in the focus countries, (ii) to identify opportunities for the development of demonstrative projects for the decarbonization of heavy industry clusters in LAC, (iii) to create guidelines for best practices, policy and regulation-making that could incentivize the decarbonization of heavy industry in beneficiary countries, and (iv) develop activities for capacity building and knowledge dissemination with governments, international stakeholders as well as the local heavy industry players.

2.2 **Heavy industry activities are related to approximately a third of total global emissions.** To limit average global warming of 1.5C compared with pre- industrial levels, it will be necessary to reach net-zero CO<sub>2</sub> emissions by 2050<sup>1</sup>. In these efforts the decarbonization of the industrial sector will be crucial: out of the almost 50 GtCO<sub>2</sub>e global annual emissions emitted in 2018, heavy industry activities contributed to about 33% of them. Most of the greenhouse gas emissions produced by industrial activities were indirect emissions caused by electricity and heat supply consumption from the network (44%), followed by direct fossil fuels consumption (37.5%) and then the industrial process itself, mostly from chemical reactions (18.5%).<sup>2</sup>

2.3 **Steel, cement, and chemical production account for 56% of the total emissions emitted globally by the industrial sector, three sectors that are expected to keep growing in the next decades.** The Iron & Steel industry produce globally 3.5GtCO<sub>2</sub>e/year, more than 60% of them originating from burning fossil fuels for heating furnaces, and most of the 40% remaining is due to indirect emissions from

<sup>1</sup> IPCC, 2021

<sup>2</sup> Climate Watch, 20201.

fossil fuel-based electricity consumption. The global chemical and plastics industry emits 3,3 GtCO<sub>2</sub>e/year, most of it due to burning fuels for energy in chemical crackers. More than half of the cement's industry emissions, 2,5 GtCO<sub>2</sub>e/year, are related with the CO<sub>2</sub> resulting from the chemical reaction necessary to convert limestone into clinker, and most of in the remaining emissions originated by burning fossil fuels for heating clinker kilns. Moreover, these activities are expected to continue growing in the mid-term driven by increased urbanization rates and demand for manufactured goods. By 2050, global cement production is expected to increase by 12%, steel production by 30%, and plastics by 150% compared with 2015 values.<sup>3</sup>

**2.4 In the LAC region, industrial emissions are highly relevant and concentrated in six countries.** In LAC annual carbon emissions stood at approximately 3,2 GtCO<sub>2</sub>e in 2017, out of which approximately 17.5% were direct emissions from industrial activities (557MtCO<sub>2</sub>e). This is a growth of 66% since 1990. Industrial sector emissions in the region are mostly originated from manufacturing and construction activities (47%, mostly iron and steel making), and industrial processes (28%, mostly cement production and construction activities). Accounting for 85% of all the region's industrial emissions, the five countries with the largest emissions from these sectors are Mexico, Brazil, Venezuela, Argentina, Colombia and Chile, while Trinidad and Tobago holds the largest industrial emissions per capita in the region (4.3 tCO<sub>2</sub>/capita)<sup>4</sup>. The most relevant industrial areas in LAC are the Northeast Atlantic coast of Mexico and the Southeastern coast of Brazil, while there are important industrial clusters in other areas such as Barranquilla in Colombia, Antofagasta and Mejillones in Chile, and Trinidad and Tobago in the Caribbean. Brazil is the largest producer of iron and steel in the region (9th in the global ranking) producing 32.2 million tons annually, or 53% of the regional total (2019), followed by Mexico (18.5 million tons)<sup>5</sup>. Brazil also leads the regional production of cement (53.8 million tons), followed by Mexico (41.8 million tons)<sup>6</sup>.

**2.5 Most of these heavy industrial activities are difficult to decarbonize, requiring a comprehensive plan combining electrification, efficient technologies, cleaner fuels, and carbon capture technologies.** While there are important opportunities in promoting the electrification of some of the heating needs of industrial activities, for example using electric arc furnaces (EAF) in the iron & steel industry or electric steam crackers in the chemical industry, there are still important barriers for its full deployment due to the high temperature requirements, high investment needs to upgrade industrial facilities, the higher prices of electricity compared with those of fossil fuels, and the still need of some chemical reactants. Low-carbon fuels and feedstocks, such as green hydrogen, green ammonia, synthetic fuels, or improved biomass, can

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<sup>3</sup> Energy Transition Commission, *Mission Possible*, 2018

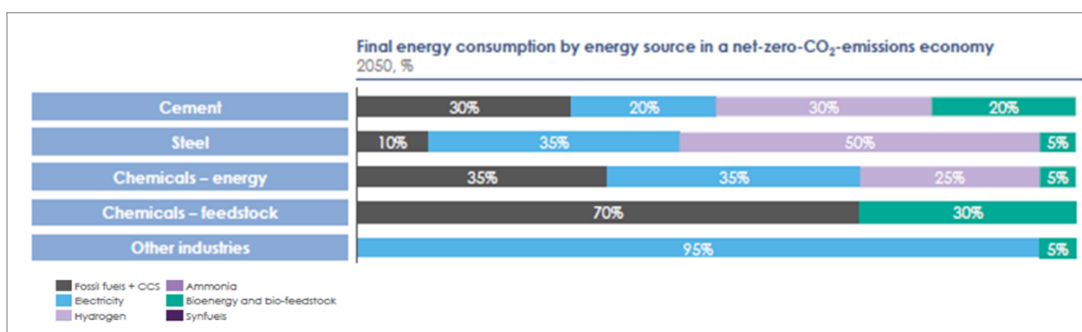
<sup>4</sup> Climatewatch, 2021

<sup>5</sup> Alacero annual Report, 2020

<sup>6</sup> FICEM annual report, 2020

provide sustainable solutions for boilers and heat supply, while unavoidable emissions from combustion exhausts or from chemical processes can be capture through new technology chemical absorbents/adsorbents, in some cases, capture technology can provide high purity carbon compounds that can be used in other economic activities. The opportunities brought by these new technologies still need to be fully understood by the industry and will require further support from the public and financial sector for the technology transformation that they imply. In 2016, 73% of global industry energy use came from direct fuel combustion, while 27% from electricity consumption<sup>7</sup>. Today, the global cement industry consumes 89% of its energy from fossil fuels (coal, natural gas, and oil), being the remaining 11% in the form of electricity. In the iron and steel industry, the main fuel being used in coal (75%), followed by electricity (12%)<sup>8</sup>. In the chemical industry the main fuels are natural gas (44%) and byproducts from the chemical process itself, where electricity accounts only for 14% of the energy matrix<sup>9</sup>. Figure 2 shows an estimation of the global energy mix necessary in heavy industries to achieve a zero-carbon economy.

*Figure 1: Final Energy Mix in a Zero carbon Economy, Mission Possible (source: ETC 2020)*



**2.6 The public sector will play a key role in creating the economic and regulatory incentives for the technology transformation that heavy industries need for their full decarbonization.** Although industrial activities are mainly driven by the private sector initiative, the role of the public sector will be extremely important to incentivize the development of decarbonization pathways, creating conducive regulatory frameworks and promoting research and innovation. This way, the public sector can accelerate the rate of adoption of new technologies, and thus contribute to a development model that is aligned with the pathways needed to fulfill the mitigation objectives of the Paris Agreement. There are five key areas where the public sector can contribute: (i) creating national strategies and technology roadmaps for the incorporation of clean fuels or efficient technologies, (ii) creating new technology and safety standards, as well as certification schemes to certify low carbon origin of fuels

<sup>7</sup> IEA, Global Energy Statistics, 2016

<sup>8</sup> EIA, technology pathways – Cement, and Iron & Steel Industries

<sup>9</sup> EIA USA – values for USA chemical industry

and industrial feedstocks, (iii) creating carbon pricing mechanisms which include the industrial sector activities, (iv) providing fiscal incentives and public financing through local development banks to support Small and Medium Enterprises (SMEs) that will bring new solutions to decarbonize the heavy industry as well as to reduce investment risks, such tailor-made green and energy transition bonds, schemes of contracts-for-differences in clean fuel markets, or sovereign-guaranteed loans, and (v) promoting research, public information, and pilot projects. All these actions will first require a deeper understanding by the public stakeholders of the heavy industry benchmarks and of the upcoming technologies breakthroughs, as well as the creation of strong public-private partnerships.

**2.7 The decarbonization of heavy industry is aligned with the Nationally Determined Contributions (NDC), economic recovery actions, and clean fuel strategies being developed by countries in LAC.** All LAC countries have submitted their first, or sometimes de second, National Determined Contributions (NDC) to the UNFCCC, most of them including the energy and industry sectors as part of their mitigation and/or adaptation actions<sup>10</sup>, while also seeking a just transition in this process for sectors that are traditionally dependent on fossil fuel supply and demand. Given the current targets in the LAC countries' NDCs, it is estimated that the market for low-carbon investments in LAC could reach \$1 trillion by 2040, with \$600 billion materializing by 2030<sup>11</sup>. These investment figures are even more important in the context of the Covid-19 pandemic, which is estimated that will drive the GDP of LAC down between 6% to 14% by 2022<sup>12</sup>making it necessary for the Governments to promote activities that drive economic development while also keeping the path of decarbonization. The aim of Trinidad and Tobago's NDC is to achieve a reduction in overall emissions from the industrial, power generation, and transportation sectors by 15% by 2030 from business as usual. Brazil's commits to reduce greenhouse gas emissions by 37% below 2005 levels in 2025, and by 43% below 2005 levels in 2030. Mexico's NDC established an unconditional commitment to reduce its GHG emissions by 22% and 51% of its black carbon emissions by 2030, compared to a business-as-usual scenario. Also, the countries in the region are taking steps towards the development of clean fuel strategies, particularly for green hydrogen, which will imply a need to understand the future demand from the industrial sector. Brazil is expected to have its National Strategy for Green Hydrogen approved by 2021, which will include addressing the domestic demand from sectors such as the industrial activities, and Trinidad and Tobago, through the IDB financed technical cooperation RG-T3777, is carrying out studies to better understand the potential synergies between its current natural-gas-based infrastructure and the upcoming low-carbon fuel economy. The TC

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<sup>10</sup> Specifically: LAC countries that included mitigation activities related with industry are 12, and with energy 22. 9 countries include energy related actions in their adaptation strategies.

<sup>11</sup> IFC, *a trillion-dollar opportunity*, 2016

<sup>12</sup> IDB, *LAC post Covid*, 2020

also finds synergies with initiatives started by the Bank such as Build Forward in the Caribbean<sup>13</sup>, as it will help finding a sustainable solution for important industries in the region, such as chemical and cement production. The project will also provide valuable inputs for the project “Creation of a Green Hydrogen Facility” (RG-T3904), as it will assess and quantify potential green hydrogen demand from the industrial sector in LAC.

## **2.8 This TC is aligned with the strategies and sectorial frameworks of the IDB.**

This TC is aligned with the following areas of the Strategic Program for Infrastructure Development Financed with Ordinary Capital by financing (i) pre-feasibility studies and (ii) regulatory and institutional analyzes to support (a) the origination of infrastructure projects, by allowing governments to resolve barriers for the development of cleaner heavy industries, (b) governance in terms of infrastructure, by facilitating the creation of regulatory frameworks, and (c) capacity building, by providing trainings and workshops on the possibilities of industrial decarbonization. The TC is also aligned with the IDB Infrastructure Strategy: Sustainable Infrastructure for Competitiveness and Inclusive Growth (GN-2710-5) in that it will support the development of socially and environmentally sustainable infrastructure, and it will promote innovative financing mechanisms to leverage the participation of the private sector. The TC is also aligned with the Bank’s 2025 Vision agreed during the governor’s assembly of 2021, as it would support sustainable economic growth by promoting upgrades in the industrial sector, the support of SMEs that would help the decarbonization path of heavy industry. and it would support the implementation of measures to mitigate the effects of climate change. This TC is aligned with the Second Update of the Institutional Strategy 2020-2023 (AB-3190-2), aligning the challenges of (i) sustainability by promoting the promotion of renewable energy, and (ii) productivity and innovation, by promoting innovative technologies that will help achieving cleaner heavy industry processes. This TC is consistent with the Energy Sector Framework Document (GN-2830-8) since the promotion of renewable energy sources is one of the principles in the energy sector and promotes initiatives to reduce carbon dioxide emissions. This operation will contribute to the GN-2727-12 Corporate Results Framework (CRF) by promoting the generation of energy from renewable energy sources. This TC is also aligned with the cross-cutting themes of climate change and environmental sustainability and with the Sectorial Framework on Climate Change (GN-2835-8), by promoting the implementation of measures in the industrial sector that contributes to reaching net-zero emissions. Finally, this TC is aligned with the country strategies of Brazil, Mexico, and Trinidad & Tobago as it would seek increasing the share of renewables in the energy matrix.

### **III. Description of activities/components and budget**

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<sup>13</sup> Build Forward is a delivery-oriented initiative aimed at helping Caribbean countries define Sustainable Development Pathways for their transformation in a smart and resilient manner.

**3.1 Component 1: Assessment of technologies to contribute to the decarbonization pathway for heavy industry in LAC.**

The objective of this component is to develop a regional strategy for the decarbonization of heavy industry activities based on the studies carried out for the beneficiary countries. This component will finance at least three studies to (i) characterize the heavy industry sector in beneficiary countries, regarding product focus, size of production, local, regional and national economic relevance, type of emissions, geographical distribution, type of technologies being used in their industrial processes, – furnaces, kilns, crackers, etc. –, energy consumption patterns, and type and amount of fuels being used; (ii) revise existing methodologies to estimate GHG emissions from the industrial sector and create baselines for the cement production, iron & steel industry, chemical and petrochemical activities, and (iii) assess and identify the most feasible and cost-effective technology options to be promoted in the beneficiary countries' heavy industry – as defined above - including aspects of energy efficiency, carbon capture, electrification or other types of modernization of facilities, use of cleaner fuels such as ammonia, methanol or green hydrogen, as well as demand-side actions such as the substitution of steel and cement by alternative construction materials, and carbon capture technologies. The expected results will include estimates of required investment related to decarbonization pathway, an economic cost-benefit analysis<sup>14</sup>, and an evaluation of the potential clean fuel demand in the countries resulting from implementation of an industrial sector decarbonization strategy. The products of this consultancy will be coordinated with the governments of the beneficiary countries, with national public stakeholders, and with the regional sectoral heavy industry associations such as ALACERO for the iron & steel industry, APLA for the chemistry sector, and FICEM for the cement industry<sup>15</sup>.

**3.2 Component 2: Identification of opportunities for the development of demonstrative projects for heavy industry decarbonization in LAC.**

This component will identify the most suitable industry clusters among beneficiary countries where demonstrative projects of heavy industry decarbonization measures could be developed, based on criteria such as the percentage on participation on national GDP, emissions per unit of energy consumed, potential externalities on local communities, and geographical advantages such as being closed to important transportation hubs. This identification work will be gathered in three studies that will (i) analyze technical and regulatory environment in beneficiary countries, (ii) propose at least three demonstrative projects that could be developed, (iii) estimate expected investment requirements for those demonstrative projects, (iv) carry out a high level cost-benefit analysis and the possibilities of integrating a circular economy approaching those

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<sup>14</sup> Economic benefits will also include job creation considerations; resilience considerations; just transition considerations.

<sup>15</sup> ALACERO: Asociación Latinoamericana del Acero, FICEM: Federación Inter-Americana del Cemento, APLA: Latin-American Petrochemical and Chemical Association

projects<sup>16</sup>, and (v) propose most suitable financial mechanisms to scale up these demonstrative projects and incentivize the adoption of this new technologies among industrial stakeholders. The work under this component will also identify international multilateral and bilateral financing sources allocating funds to promote industry decarbonization measures.

- 3.3 **Component 3: Guidelines for policy and regulation-making to incentivize the decarbonization of heavy industry.** This component will finance at least three analyses of key regulatory barriers for the development of an industrial decarbonization program in beneficiary countries and propose a strategy to overcome them. The key barriers to be analyzed will be those limiting adoption of new technologies and energy efficiency improvements by industrial stakeholders, limiting the adoption of new energy sources such as clean fuel, and limiting the availability of financial resources to implement these decarbonization measures. The analysis will include recommendations for (i) the design of national strategies for the decarbonization of heavy industry, (ii) the development of technology and safety standards regarding the use of clean fuels and electrification measures in heavy industry processes, and (iii) the development of clean labelling systems for industrial products and an analysis of the international trading requirements being currently developed for the heavy industry products.
- 3.4 **Component 4: Capacity building and knowledge dissemination.** This component will finance the organization of at least three regional workshops, and dissemination activities, to present and discuss the findings of the studies carried out in components 1 to 3. This component will also support the creation of a publication with the key findings of the TC and the integration of the data gathered during the development of those studies (emissions, energy consumption, potential demand) in the already existent open knowledge platforms at the IDB.

#### IV. Budget

Indicative Budget

Activity/Component	IDB/Infrafund	Total Funding
Component 1: Assessment of an array technologies to contribute in to the decarbonization pathway for heavy industry in LAC	\$75,000	\$75,000
Component 2: Identification of opportunities for the development of demonstrative projects for heavy industry decarbonization in LAC.	\$60,000	\$60,000
Component 3: Guidelines for policy and regulation-making to incentivize the decarbonization of heavy industry.	\$50,000	\$50,000

<sup>16</sup> The waste (heat) of an industry could be used as the input for another, and hence the optimal usage of waste may lead to a further decarbonization.



Component 4: Capacity building and knowledge dissemination.	\$15,000	\$15,000
<b>TOTAL</b>	<b>\$200,000</b>	<b>\$200,000</b>

## V. Executing agency and execution structure.

- 5.1 The Bank, through the Special Group for Mining, Geothermal Energy, and Hydrocarbons (INE/ENE) will act as the executing agency upon request of beneficiary countries<sup>17</sup>: Ministry of Planning and Development of Trinidad and Tobago, Secretariat of International Economic Affairs of Brazil, and the Secretariat of Natural Resources of Mexico. This is due the regional nature of the TC, where a legal entity able to execute the project cannot be identified. Also, due to its ability to leverage its extensive network of internal and external subject-matter experts and well-established relationships with the stakeholders involved. The Bank will contract individual consultants, consulting firms, and non-consulting services in accordance with the Bank's current procurement policies and procedures. This is aligned with the OP- 619-4. INE/ENE will closely coordinate with the Country Offices of the beneficiary countries. For Bank-executed operations: Recruitment of individual consultants AM- 650; Contracting of consulting firms for services of an intellectual nature GN- 2765-4 and its operational guidelines OP- 1155- 4; and Procurement of logistics services and purchase of goods GN- 2303- 28.
- 5.2 The IDB will lead the implementation, the programmatic oversight of the different activities, and coordinate the reporting of results with other organizations operating at the national level. The work of this TC will be closely coordinated with the key counterparts of the countries and beneficiaries of the services of this TC, namely: Secretariat of Environment and Natural Resources of Mexico (SEMARNAT), Ministry of Energy and Mines in Brazil (MME), and the National Energy Company (NEC) in Trinidad and Tobago.

## VI. Project risks and issues

- 6.1 The foreseeable risks associated with this TC: are (a) uncertainty caused by the Covid-19 pandemic that can still delay the work of counterparts and consultants and delay the production of the expected deliverables, which will be mitigating by avoiding planning any travelling activity and by establishing solid telecommunication platforms to work with the stakeholders, and (b) a lack of appropriation of the results of the TC by the countries due to lack of priorities in the political agenda, which will be mitigated by raising awareness campaigns on the results, the creation of publications, and the involvement of the industry associations.

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<sup>17</sup> Two of the beneficiary countries, Brazil and Trinidad and Tobago, have presented a written request to the Bank to execute this TC. According to OP-619-4 Annex II Section 2.1., the activities in Mexico will only begin to be executed and the respective funds disbursed once the letters of request have been obtained from the relevant official liaison entities with the Bank or, a non-objection letter is received from them in cases where the requests come from bodies or entities other than the country's official liaison entity with the Bank.

## **VII. Environmental and Social Classification**

- 7.1 According to the OP-703 the environmental and social classification for this operation has been assigned as category C. Given that no significant environmental and social risks and impacts have been identified, no environmental assessment studies or consultations are required for this Category "C" operation.

## **VIII. Annexes:**

[Request from the Client - RG-T3918](#)

[Results Matrix - RG-T3918](#)

[Terms of Reference - RG-T3918](#)

[Procurement Plan - RG-T3918](#)