



# EMERGING RISKS

## Ecopetrol 2022

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**Corporate Integrated Risk Management Administration**  
**Corporate Vice Presidency of Compliance**

### Emerging risks



Ecopetrol defines emerging risks as the that are expected to have a long-term future impact on the company (3-5 years and beyond) or in some instances, they have already begun to impact the company. Emerging risks are considered those that meet some of the following characteristics:

1. The risk is new, developing, or significantly increasing in importance.
2. A familiar risk in a new or unfamiliar context or under new context conditions (re-emerging)
3. The potential material financial or reputational impact of the risk is long-term and significant.
4. It is an external risk that arises from events external to the company which are beyond its influence or control.
5. The risk and its impact on the company are specific.
6. Has a high potential impact to Ecopetrol and may require Ecopetrol to adapt its strategy and/or business model.



## Emerging risk Management Lifecycle



Emerging Risks in Ecopetrol are evaluated as part of the Company's Risk Management, which is framed in Ecopetrol's Integral Policy. Likewise, through the Risk Management Cycle, we seek an adequate understanding, analysis, and recording of these risks, using the methodology set by the Company.



**Ecopetrol's risk management lifecycle used for emerging risk management.**

Below is a high-level summary of the key steps in Ecopetrol's emerging risk management lifecycle:

**1. Plan:** As part of the emerging risk planning process, Ecopetrol utilizes qualitative and quantitative research methods to perform industry scanning and gather internal information to enable the identification of emerging trends.

**2. Identify:** Based on the emerging trends identified, Ecopetrol reviews each trend and identifies the potential emerging risks that may impact Ecopetrol.

**3. Evaluate / Review:** Ecopetrol reviews each of the potential emerging risks and rates them based on the following criteria:

- Potential Impact
- Speed of Emergence

**4. Handle / Treat:** The assessment allows Ecopetrol to prioritize the potential emerging risks and determine the appropriate risk treatment plans. Ecopetrol assesses each potential risk and defines the treatment plan for each of the emerging risks identified. Ecopetrol's emerging risk treatment plans include the following:

- New Enterprise Risk
- Incorporation into Existing Enterprise Risk
- Ongoing Monitoring of the Emerging Risks
- Drop Emerging Risk.

## Trend Identification



External risks arise from events outside the organization and are typically beyond Ecopetrol's control. The trends include natural disasters and geopolitical and macroeconomic shifts. Ecopetrol cannot prevent such risks from occurring and, consequently, needs to focus on the identification of such trends/risks and related mitigating measures.



In the trend identification stage, Ecopetrol determines, in a systematic and structured way, the emerging trends that may affect its overall business strategy and operations. To ensure adequate trend identification, Ecopetrol deploys the following approach:

Signal Scanning	STEP Framework	Trends Criteria
Using qualitative and quantitative research methods, Ecopetrol identifies patterns that lead to insights for more informed decision making.	STEP (Social & People, Technology, Economic, Political & Regulatory, plus Environmental) is the approach used to landscape assessments, taking into consideration the environmental conditions that impact the organization outside of its control.	To arrive at a set of trends that represent the emerging risk landscape for Ecopetrol, the trends are outlined to meet the following criteria: <b>Consistent Elevation:</b> all the trends look at patterns of signals across the industry, rather than single data points, but are specific enough to demonstrate a connection, direct or indirect, to the industry and organization. <b>Mutually Exclusive, Collectively Exhaustive (MECE):</b> Each trend is unique and distinct from the others, without overlap. The aggregate of all trends is exhaustive and doesn't leave any critical areas unaddressed. <b>Both Opportunity and Risk:</b> The trend indicates risk to the organization, but also opportunity from which strategic planning could be derived.

The following activities were carried out as part of the qualitative and quantitative method Ecopetrol deployed:

- ✓ Consultation of published reports and / or interviews with partners of consulting firms.
- ✓ Analysis of studies published by insurance companies and risk rating firms.
- ✓ Information on the industry, economics and, geopolitical issues in the regions where Ecopetrol operates.
- ✓ Consultation of public information on risks, of the main companies in the sector with better ratings.
- ✓ Information and strategic intelligence studies of the World Economic Forum – the global risk report 2022.

The trends identified under the STEPA framework are classified into the categories applied by the World Economic Forum (social, technological, economic, geopolitical and environmental) and are reviewed against the following aspects:

- ✓ Internal information (e.g., Company strategy, business risk management documentation) review.
- ✓ The current and expected context of the Energy and Oil & Gas sector worldwide.
- ✓ The risk profiles of the companies in the sector and the relevant issues of the country.

## Trend Identification



Based on the analysis carried out, Ecopetrol identified the following fourteen trends in the company's external environment, classified into the categories used by the World Economic Forum, as follows:



 <b>Societal</b>	 <b>Environmental</b>	 <b>Economic</b>	 <b>Technological</b>	 <b>Geopolitical</b>
<p>Companies may be unprepared to face the rapidly changing behavior of fossil fuel consumers, which may reduce demand for carbon-intensive goods. The erosion of social cohesion, which includes greater inequality and an increase in the number of people living in poverty, has worsened as a consequence of the COVID-19 pandemic crisis. This situation also affects the generation of employment for less qualified workers, resulting in higher unemployment and deterioration of job conditions.</p> <p>-----</p> <p><b>Trends:</b></p> <ul style="list-style-type: none"> <li>▪ Pressures due to the acceleration of the effects of climate change.</li> <li>▪ Consumer behavior trickle up effects.</li> <li>▪ Shortage of human talent in Oil &amp; Gas.</li> <li>▪ Increase in social issues.</li> </ul>	<p>Although commitments have been made by governments at the COPs, it is possible that the established goals will not be achieved within the estimated timeframe due to possible limitations on the capital available for climate action in some countries. Increasingly extreme and more frequent climatic phenomena would generate water shortages and, in turn, displacement of people. The loss of biodiversity and damage to ecosystems due to human activity would generate reparable impacts, together with food, water and other critical natural resource crises.</p> <p>-----</p> <p><b>Trends:</b></p> <ul style="list-style-type: none"> <li>▪ Pressures due to the acceleration of climate change effects.</li> <li>▪ Possible non-compliance with climate change goals.</li> </ul>	<p>Commodity prices could continue to rise and supply chain disruptions could continue. Inflation in several countries would lead to possible increases in interest rates, impacts that are intensified for governments whose debt has increased in the wake of the COVID-19 pandemic. This, coupled with an increase in the dollar index, would result in higher debt and deleveraging risk.</p> <p>-----</p> <p><b>Trends:</b></p> <ul style="list-style-type: none"> <li>▪ Supply chain challenges.</li> <li>▪ Public finance and economic performance.</li> <li>▪ Redirection of global investment.</li> </ul>	<p>Innovation in digital transformation is bringing new capabilities to the oil and gas industry, including exploration and production (E&amp;P), but such technology transformation must also contribute to climate action with cost-effective tools. Accordingly, companies must seize opportunities to invest in low-emission technologies to avoid falling behind in their responsibility for climate action. Vulnerabilities due to dependence on cybernetworks could generate saturation or shut down of critical digital infrastructure. Cyber-attacks are becoming more frequent and more advanced, so infrastructure may become obsolete.</p> <p>-----</p> <p><b>Trends:</b></p> <ul style="list-style-type: none"> <li>▪ Innovation and Digital Transformation.</li> <li>▪ Social networks and misinformation.</li> </ul>	<p>Tensions and growing geopolitical rivalries affect political relations and generate difficulties in doing business, investment restrictions and monetary barriers. Conflicts between states could lead to biological attacks, military interventions, regional instability, among others. New regulations in Colombia that could influence the O&amp;G sector, such as a ban on fracking, tax reform, agricultural reform, labor reform, among others.</p> <p>-----</p> <p><b>Trends:</b></p> <ul style="list-style-type: none"> <li>▪ Global geopolitical instability</li> <li>▪ New government policies.</li> <li>▪ Government commitments to local ecosystems.</li> </ul>

## Potential Emerging Risk Identification



Ecopetrol analyzed each of the trends identified in previous steps and defined the emerging risks based on them. The following is a list of the twenty emerging risks identified:

Category	Name of the trend	Name of the emerging risk 2022
Societal	Consumer behavior trickle up effects	Acceleration in the race to net zero emissions
Societal	Shortage of human talent in Oil & Gas	Skilled Workers
Societal	Increase in social issues	Social erosion
Societal	Pressures due to the acceleration of the effects of climate change	Uncertainty regarding the requirements and expectations of stakeholders to achieve a fair, gradual and participatory energy transition in Colombia.
Societal	Consumer behavior trickle up effects	Conflicting Strategic Priorities
Environmental	Possible non-compliance with climate change goals	Speed of Diversification
Environmental	Possible non-compliance with climate change goals.	Effects of asset abandonment
Environmental	Pressures due to the acceleration of climate change effects	Extreme Weather Events
Economic	Supply chain challenges	Unavailability of raw materials
Economic	Supply chain challenges	Anticipated decline in demand
Economic	Supply chain challenges	Decrease in investment or financial support to O&G companies
Economic	Supply chain challenges	Insurance limitations – D&O
Economic	Public finances and economic performance	Affordable renewable energies
Economic	Global investment reorientation	Loss of market competitiveness
Technological	Innovation and digital transformation	Technology Enabled Natural Capital Solutions
Technological	Social networks and misinformation	Information Transparency
Geopolitical	New government policies	Shifting Export Regulations
Geopolitical	New government policies	New regulations
Geopolitical	Global geopolitical instability	Price and availability monitoring
Geopolitical	Government commitments to local ecosystems	New sustainable development policies



## Emerging Risks Evaluate



Emerging risks identified are evaluated based on impact and emergency speed criteria, as follows:



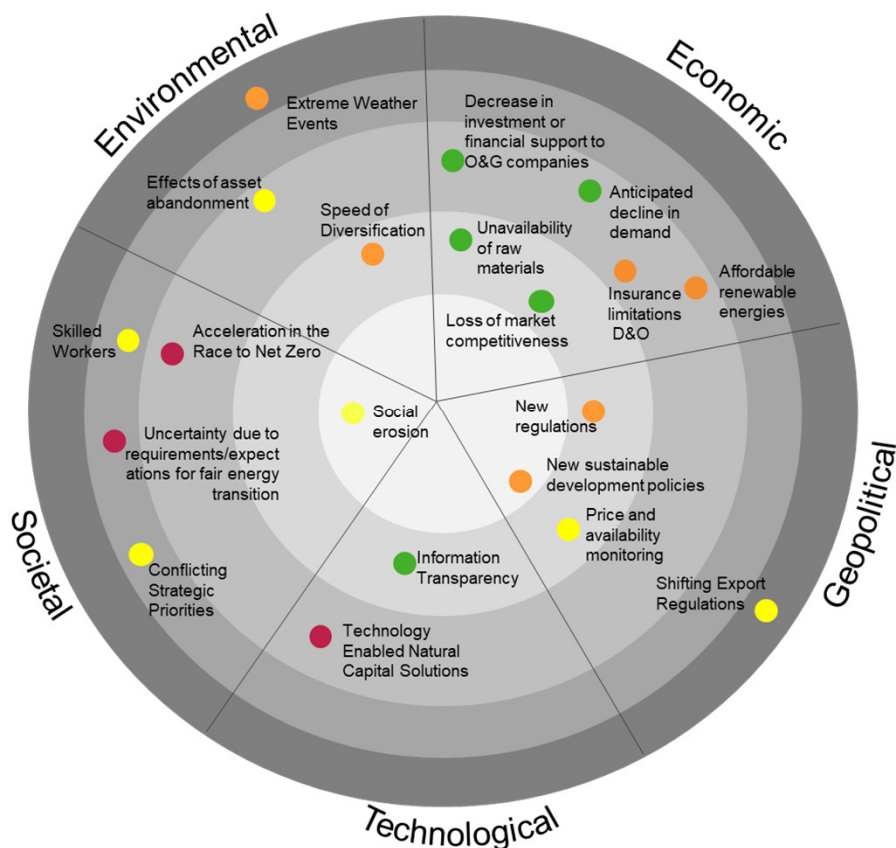
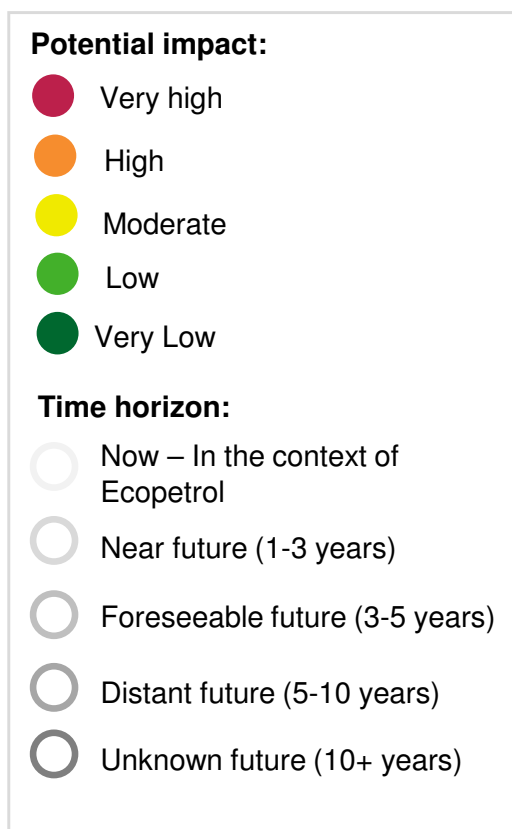
- ✓ **Potential Impact Rating:** How much of an impact would this risk have on Ecopetrol if it materializes.
- ✓ **Speed of Emergence:** How quickly will this potential risk take to emerge.

Impact Rating	Rating Description
Very High	<ul style="list-style-type: none"> <li>▪ Significant impact short-term and long-term operations (extensive operational disruptions and/or economic affectation greater than USD150M, and/or irreparable environmental damage in a large area, or in nature preservation areas)</li> <li>▪ Significant short-term and long-term impact to reputation (Prolonged coverage of national and / or international press media, and/or major loss of market share for nationally marketed products)</li> <li>▪ Significant impact to long-term strategic objectives and business model, major impact to Company's ability to meet business objectives and near-term initiatives</li> <li>▪ Significant legal / regulatory actions or fines (Loss of license to operate in significant markets, and/or condemnation by international organizations)</li> </ul>
High	<ul style="list-style-type: none"> <li>▪ Significant impact on operations in the short-term, major impact on long-term operations (prolonged operational disruptions and/or economic affectation between USD50M and USD150M, and/or scattered or severe environmental damage in a specific area, or in nature preservation areas)</li> <li>▪ Significant short-term and long-term impact to reputation (coverage of national press media, and/or loss of market share for nationally marketed products)</li> <li>▪ Major impact to Company's ability to meet business objectives and near-term initiatives. Some impact to long-term strategic objectives and business model</li> <li>▪ Moderate legal / regulatory actions or fines (Potential loss of license to operate in significant markets and/or condemnation national organizations)</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>▪ Major impact on operations in the short-term (long operational disruptions and/or economic affectation between USD10M and USD50M, and/or environmental damage in a located area)</li> <li>▪ Major short-term impact to reputations (coverage of national or regional press media and/or impact on the commercial relationship with customers)</li> <li>▪ Moderate impact to Company's ability to meet business objectives and near-term initiatives, minor impact to Company's ability to meet long-term strategic objectives</li> <li>▪ Some legal / regulatory actions or fines (opening of investigations by national or international control entities)</li> </ul>
Low	<ul style="list-style-type: none"> <li>▪ Minor impact to operations (short operational disruptions and/or economic affectation between USD1M and USD10M, and/or mild environmental damage)</li> <li>▪ Some short-term impact to reputations (coverage of regional press media and/or mild impact on the commercial relationship with customers)</li> <li>▪ Some impact on Company's ability to meet business objectives and near-term initiatives</li> <li>▪ Minor legal / regulatory actions or fines (opening of internal investigations)</li> </ul>
Very Low	<ul style="list-style-type: none"> <li>▪ Minimal to no operational impact</li> <li>▪ Minimal to no impact to reputation</li> <li>▪ Minimal impact on Company's ability to meet business objectives and near-term initiatives</li> <li>▪ Little to no legal / regulatory actions or fines</li> </ul>

Speed of Emergence Rating	Now	Near Future	Foreseeable Future	Distant Future	Unknown Future
Speed in Years	starting to experience	1 - 3 Years	>3 - 5 Years	>5 - 10 Years	10+ Years

## Emerging risk radar

The following is a graphic representation of the evaluation of emerging risks.



The description of each risk in the graph above indicates the emerging nature and its most significant long-term impacts. While some aspects of the risks defined by Ecopetrol may not have been entirely unprecedented before 2022, they have arisen in new, changing, and unfamiliar contexts. More importantly, in our estimation, they are significantly increasing in importance to Ecopetrol, a key consideration in our risk analysis, because local government requirements on the matter are beyond Ecopetrol' s control.

## Principal emerging risks

According to the analysis and methodological application carried out for the identification of emerging risks, the risks that meet all these parameters are listed below:

1 - Acceleration in the race to net zero emissions

2 - Technology Enabled Natural Capital Solutions

## RE #1: Acceleration in the race to Net Zero Emissions

WEF categories\*: **Societal<sup>1</sup>**  Environmental  Economic  Technological  Geopolitical 

Trend: Consumer behavior trickle up effects.

### Description of Emerging Risk

The risk that climate change and sustainability initiatives (e.g., Colombia's Climate Action Law, climate summits - COP, tax credits, carbon credits) and the acceleration of reliable and cost-effective green alternatives could affect Ecopetrol's energy diversification portfolio and strategic prioritization, and lead to increased expenditures related to green initiatives and reduced demand for Ecopetrol's core products.

### Emerging Risk Background

This risk has arisen in a changing context in the area of climate change and sustainability, which has given rise to greater awareness of the effects of climate change and, according to the World Economic Forum's "Social" category trend, has generated social pressure around the future of energy (from employment to environmental protection, health, and welfare). For its part, in 2021, the Colombian government enacted the Climate Action Law reinforcing Colombia's commitment to action against climate change. The law adopts the Colombian Carbon Neutrality Strategy launched in April 2021 by the Ministry of Environment and Sustainable Development that promotes the ambition to reduce GHG emissions to achieve carbon neutrality by 2050, also, the Colombian government has included in its legislation decisions to reduce its GHG emissions, beyond having a mostly clean electricity generation matrix. Achieving the proposed objectives requires moving forward decisively in a strategy that involves diversifying the energy matrix by increasing the participation of renewable sources and promoting the use of cleaner technologies.

### Potential impact to Ecopetrol

The risk continues to significantly increase its importance in Ecopetrol due to its impact on the business and the need to adapt the strategy and business models, as shown below:

#### Impacts on the business:

- To the extent that Ecopetrol operates primarily in the oil and gas industry, it would be affected as it would need to diversify its energy portfolio more rapidly, a situation for which the Company may not be prepared.
- Accelerating domestic and international net zero emissions commitments may also affect Ecopetrol's ability to access financing and increase capital costs.
- Affecting Ecopetrol's energy diversification portfolio and strategic priorities would lead to increased spending related to green initiatives and lower demand for Ecopetrol's core products.
- Accelerating efforts to phase out coal power and inefficient fossil fuel subsidies could affect Ecopetrol's financial stability.
- There could be a disruptive impact on the supply chain and transportation channels, putting pressure on energy systems that rely on fossil fuels.

#### Impacts on strategy adaptation or business models:

- Ecopetrol must adjust its strategic priorities and projections in the diversification of its energy portfolio, given that its operations are mainly focused on the Oil & Gas industry. This requires making decisive progress in a strategy that involves diversifying the energy matrix, increasing the participation of renewable sources, and promoting the use of cleaner technologies.
- The global vision on climate change and the reduction of fossil fuels has changed the strategy of many national and international companies, which are updating their strategies to rely less on fossil fuels as alternatives become more reliable and profitable. This could affect both Ecopetrol's market position and decision-making in the face of exponential growth in decarbonization and green alternatives.

Impacts are expected to occur over the next 3-5 years if national environmental efforts increase and begin to focus directly on fossil fuels. While public and private actions accelerate the transition from fossil fuels to electric transportation, and beyond the goals stated in the national Climate Action Act, the Paris Agreement, COP agreements, among others.

1. In accordance with the guidelines of the World Economic Forum, there is a global trend that social pressure around the energy future is categorized as a social risk. See [https://www3.weforum.org/docs/WEF\\_Global\\_Risk\\_Report\\_2020.pdf](https://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf), page 37 and [https://www3.weforum.org/docs/WEF\\_The\\_Global\\_Risks\\_Report\\_2022.pdf](https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf) pag 35.





## RE #1: Acceleration in the race to Net Zero Emissions

WEF categories\*: **Societal<sup>1</sup>**  Environmental  Economic  Technological  Geopolitical 

Trend: Consumer behavior trickle up effects.

### Mitigation Activities

- Alignment with TCFD<sup>2</sup> and SASB recommendations to respond to investor demands. Based on the TCFD framework, the company continues to make progress in identifying climate change risks and opportunities and scenario analysis, which will improve Ecopetrol's ability to manage climate change-related risks and opportunities.
- Continued updating and verification of the GHG inventory to inform decision-making around decarbonization targets<sup>3</sup>. The company will review its GHG emissions reduction targets once the O&G sector guidance from the Science-Based Targets initiative is published.
- Diversification into low-carbon businesses by entering the power transmission market through the acquisition of 51.4% of ISA, and applying an internal carbon price to current and future projects.
- The gradual incorporation of cost-effective low-carbon technologies (e.g., energy efficiency, fugitive emissions reduction, wind reduction, methane flaring, renewable energies, and biofuels), in addition to the implementation of the Strategic Plan for Hydrogen production and the structuring of the CCUS roadmap.
- Development and consolidation of a portfolio of natural climate solutions to reduce residual emissions.
- Active participation in the development of public policy documents related to Climate Change.
- Adoption of global initiatives that promote GHG reduction (Climate and Clean Air Coalition, Zero Routine Flaring, Climate Action 100+, TCFD, TNFD).



<sup>2</sup>. See TCFD report: [https://www.ecopetrol.com.co/wps/wcm/connect/7ff79929-fc1e-44e3-acf1-50ff338ca992/ECOPETROL+\\_+TCFD\\_INGLES+20220923.pdf?MOD=AJPERES&attachment=false&id=1663970471637](https://www.ecopetrol.com.co/wps/wcm/connect/7ff79929-fc1e-44e3-acf1-50ff338ca992/ECOPETROL+_+TCFD_INGLES+20220923.pdf?MOD=AJPERES&attachment=false&id=1663970471637)

<sup>3</sup>. Ecopetrol's GHG reduction targets include reducing emissions by 25% in 2030 and achieve net zero GHG emissions by 2050 for scopes 1 and 2. In terms of total emissions (scopes 1, 2 and 3), achieve a 50% reduction by 2050, compared to a 2019 baseline.

## RE #2: Technology Enabled Natural Capital Solutions<sup>4</sup>

WEF categories\*: Societal  Environmental  Economic  **Technological<sup>5</sup>**  Geopolitical 

Trend: Innovation and digital transformation

### Description of Emerging Risk

The risk that Ecopetrol does not adequately adapt and develop the technological capabilities (e.g. environmental monitoring technologies, Big Data analysis, remote sensing, robotics, drones, artificial intelligence, Nature Based Solutions -SBN, Natural Climate Solutions - SNCL, among others) required to effectively address, enable, assess and report the reduction of its impact, identification of risks, dependencies and opportunities on Colombia's biodiversity and nature (e.g. pollution, habitat loss, deforestation, restoration, conservation, bio-economy, GHG emissions, among others).

### Emerging Risk Background

In 2022, the World Economic Forum's Global Risk Report<sup>6</sup> (WEF) maintains biodiversity loss, ecosystem collapse, and human-induced environmental damage as one of the top risks. The WEF highlighted biodiversity loss as an essential global threat, indicating that biodiversity loss is gaining increasing prominence. The response to ensure that companies adequately report and identify their impact on biodiversity is being considered under the Task Force on Nature-related Financial Disclosures (TCFD), which aims to create a standardized way to measure threats to wildlife and ecosystems. There are no simple metrics for measuring impacts on biodiversity. However, as governments and investors begin to turn their attention on pollution, habitat loss, urbanization, and deforestation, the development and effective use of digital capabilities and technology to collect relevant information will be required. Data provides information and mitigation opportunities to meet potential future regulations and disclosures in the coming years. Financial institutions are also seeking more accurate and transparent information from companies on their management of biodiversity loss risks, especially within the oil and gas sector.

### Potential impact to Ecopetrol

The absence of technological capabilities and developments to effectively enable, assess and report on natural capital and the reduction of the impact on Colombian biodiversity would generate significant impacts on the company's business and strategy, as explained below.

#### Impacts on the business:

- Not having tools to measure or avoid affecting biodiversity, as a result of the company's operations, would lead Ecopetrol to be unsustainable. This is how the World Economic Forum is measuring and looking at it, categorizing it as the main risk of the impact on biodiversity. This is already being measured by TNFD<sup>7</sup>, which aims to create a standardized way of measuring threats to wildlife and ecosystems.
- Not being able to measure technological-natural capital-, the reductions of the impact on biodiversity (pollution, habitat loss, urbanization, deforestation, etc.) by a company mainly dedicated to Oil & Gas despite the growing global demand to do so, may have effects on the impossibility of complying with the requirements of financial institutions, local and international regulations on biodiversity protection, generating a loss of markets and a negative impact on the perception of stakeholders about Ecopetrol.
- Not having the appropriate technology to measure the impact on biodiversity would prevent Ecopetrol from complying promptly with the increased demands, social restrictions, and regulatory restrictions on the matter, which would lead, for example, to the closure of operations in its areas of interest.
- This could lead to a decrease in the availability of ecosystem services on which Ecopetrol's operations depend (e.g., not having the technology to measure water consumption and availability in operations could lead to a shortage of this water service).
- Ecopetrol would have limited capacity to adequately quantify CO2 capture and storage from nature-based climate solutions.
- Ecopetrol's areas of operations could have increased vulnerability to climate-related events that could potentially affect biodiversity.

4. Natural capital is an environmental term that measures the natural resources of ecosystems and the biosphere.

<https://www.weforum.org/agenda/2021/08/natural-capital-key-future-investment/>

5. According to World Economic Forum guidelines, digital transformation is a necessary trend to enable natural capital solutions. These solutions are important for Ecopetrol to maintain its positioning within the markets and among stakeholders. This trend is categorized as a technological risk.

6. [https://www3.weforum.org/docs/WEF\\_The\\_Global\\_Risks\\_Report\\_2022.pdf](https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf) page 93.

7. TNFD - Taskforce on Nature-related Financial Disclosures.

## RE #2: Technology Enabled Natural Capital Solutions<sup>4</sup>

WEF categories\*: Societal 

Environmental 

Economic 

Technological<sup>5</sup> 

Geopolitical 

**Trend: Innovation and digital transformation**

### Potential impact to Ecopetrol

#### Impacts on strategy adaptation or business models:

- Ecopetrol will need to adapt its strategy by including technological capabilities and strategies (e.g., nature-based solutions, Big Data analytics, remote sensing, robotics and drones, artificial intelligence) to effectively enable the reduction of its impact on Colombia's biodiversity (e.g., pollution, habitat loss, deforestation, and GHG emissions).

These impacts are "long term" due to the risk of not being able to develop technological capabilities to assess and reduce environmental impact, meet the country's biodiversity expectations, and fulfill its strategic objective of being Colombia's leading oil and gas company. Reliance on technology for these efforts is relatively new and has increased significantly in importance. Unlike other oil and gas companies, Ecopetrol operates primarily in Colombia, whose ecosystem and biodiversity are particularly sensitive to disturbance. This poses unique challenges in controlling and limiting impacts. Ecopetrol's market share is equally sensitive to this risk and could be significantly diminished if the company were unable to control and minimize environmental disruptions.

### Mitigation Activities

- Participation as an active member of the TNFD Working Group on Nature-Related Financial Disclosures to anticipate management frameworks for reporting and acting on the evolution of nature-related risks and implementing the recommendations of this new management and reporting framework.
- Development of a consultancy to define the conceptual and methodological framework for natural capital management in Ecopetrol's operations and projects.
- Generation of tools to measure natural capital management of projects and operations.
- Incorporation of biodiversity baselines of prioritized ecosystems (Magdalena Medio and Orinoquia), and installation of 600 cameras that monitor biodiversity, which resulted in 194 regionalized bio models of species distribution, in future environmental studies for projects and operations.
- Implementation of the socio-ecological resilience tool to analyze the potential impacts of future interventions.
- Monitoring of springs and potential spill sites through genetic analysis to identify native strains of microorganisms that allow bioremediation measures in case of oil spills.
- Development of soil amendments, based on oil molecules, to increase carbon sequestration capacity, regulation of the water cycle, and protection and strengthening biodiversity.
- Promotion of regenerative agriculture through the establishment of mixed cropping systems (including cocoa and native trees) on disturbed soils, to improve soil quality, increase tree cover, strengthen biodiversity, and promote better incomes for the population.
- Launch of a nano-satellite with multispectral imaging capabilities to monitor forest cover and methane and carbon dioxide emissions into the atmosphere.
- Development of technologies for the cost-effective treatment of water produced in the Orinoquia's fields and its reuse in the irrigation of agroindustrial and wood energy plantations.
- Strengthen the portfolio of Natural Climate Solutions.
- Generate information and data on nature and biodiversity to support natural capital management.
- Capacity building for natural capital management, nature-based solutions, and natural climate solutions.
- Disseminate and massify the use of the nature-based solutions platform.
- Research study on "CO<sub>2</sub> capture in natural sinks" to reduce uncertainty in the quantification of capture and storage of CO<sub>2</sub> and other greenhouse gases.

4. Natural capital is an environmental term that measures the natural resources of ecosystems and the biosphere.

<https://www.weforum.org/agenda/2021/08/natural-capital-key-future-investment/>

5. According to World Economic Forum guidelines, digital transformation is a necessary trend to enable natural capital solutions. These solutions are important for Ecopetrol to maintain its positioning within the markets and among stakeholders. This trend is categorized as a technological risk.



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CONSTRUIR UNA EMPRESA Y UN PAÍS  
—— DE TODOS, PARA TODOS ——

