Economics World Cup 2025

Final Round Case Study

Brazil, As Seen From Space
Source: CIA Factbook

Over 515 labour hours were spent into the production of this case study.

Special thanks to: Dr. Craig Holmes from the University of Oxford, Coraline Anne from Goldman Sachs, Kush Mahawar from Lazard, Aditya Sinha from Citibank, and Members of Oxford Finance Society for their contributions.

This Case Study is based on a real scenario. Certain figures, numbers, and locations may have been fictionalized in order to protect the confidentiality of our sources.

This case is designed to take **5-10 hours** to solve. During the 2025 EWC, teams were given 7 days to solve this case.

Section 1: Introduction

Introduction

Welcome. You are a consultant at *Bartley & Associates*, a boutique advisory firm that supports governments with long-term economic strategy, infrastructure investment, and resource planning.

Your latest assignment brings you to Brazil, a resource-rich country that finds itself at the center of a new global race for the mineral that powers electric vehicles: graphite.

Sleek, black, and essential, this mineral is the unsung hero of EV batteries, and the world wants more of it.

Resource explorers recently discovered untapped graphite reserves in Brazil's Rondônia State. Tapping into these reserves could be a highly lucrative venture: there are several international buyers ready to purchase many millions of tons of graphite. However, setting up the infrastructure to export these reserves may require significant upfront investment and expense.

The Brazilian Ministry of Mines and Energy is not sure whether this would be a profitable venture, and has therefore hired Bartley & Associates to assess whether this effort is economically viable, and if it is, then what might be the best way to extract these resources.

Your team's task is to analyze the logistical, financial, and geographic aspects of mineral extraction and recommend whether the government should move forward with development plans, and if so, *how* the government should move forward.

In this document, you will receive a project briefing that includes data on:

- Current and projected market prices for minerals
- Mineral deposit locations and estimated volumes
- Costs of building infrastructure
- Costs of operating transport links
- And other project parameters

Your team's mission is to produce a clear, evidence-based recommendation:

- Should Brazil invest in extracting these resources now?
- If so, what is the most profitable, cost-effective, and strategically sound plan to do so?

This is not a numbers exercise. It's a real-world challenge with billion-dollar implications. Your findings will help shape Brazil's position in the future of the electric revolution.

Through this case study, your team will explore and refine your skills in **key economic concepts** such as:

Cost-Benefit Analysis: The ability to evaluate the costs and benefits of different options for upgrading the graphite supply chain.

Opportunity Cost: The ability to discuss the trade-offs of allocating funds to various options within this project.

Supply and Demand: The ability to consider how the demand for a commodity in one region impacts the supply chain of the commodity in another region.

Marginal Analysis: The ability to evaluate the effect of incremental changes in resource allocation on overall outcomes.

Externalities: The ability to analyze the social and environmental impacts of your recommendations.

Budget Constraints: The ability to work within the given budgetary limitations to propose a feasible plan.

Risk Management: The ability to assess uncertainty, weigh probabilities of different outcomes, and design strategies that minimize potential downsides.

Section 2: Market Analysis

Graphite: Fueling the Future, One Battery at a Time

Graphite is a naturally occurring form of carbon that plays a critical role in modern technology.

Its unique combination of high conductivity, thermal resistance, and lubricating properties makes it essential across industries, from steelmaking to electronics.

Most notably, graphite is a core component of lithium-ion batteries, used in electric vehicles and energy storage systems. In fact, each EV battery contains up to 70 kilograms of graphite, more than any other mineral input.

With the global shift toward electrification and net-zero targets, demand for graphite is soaring. According to industry forecasts, global graphite demand could triple by 2030. Yet, unlike many critical minerals, graphite is not currently produced at scale in most Western countries, creating a supply chain heavily reliant on a few key exporters.

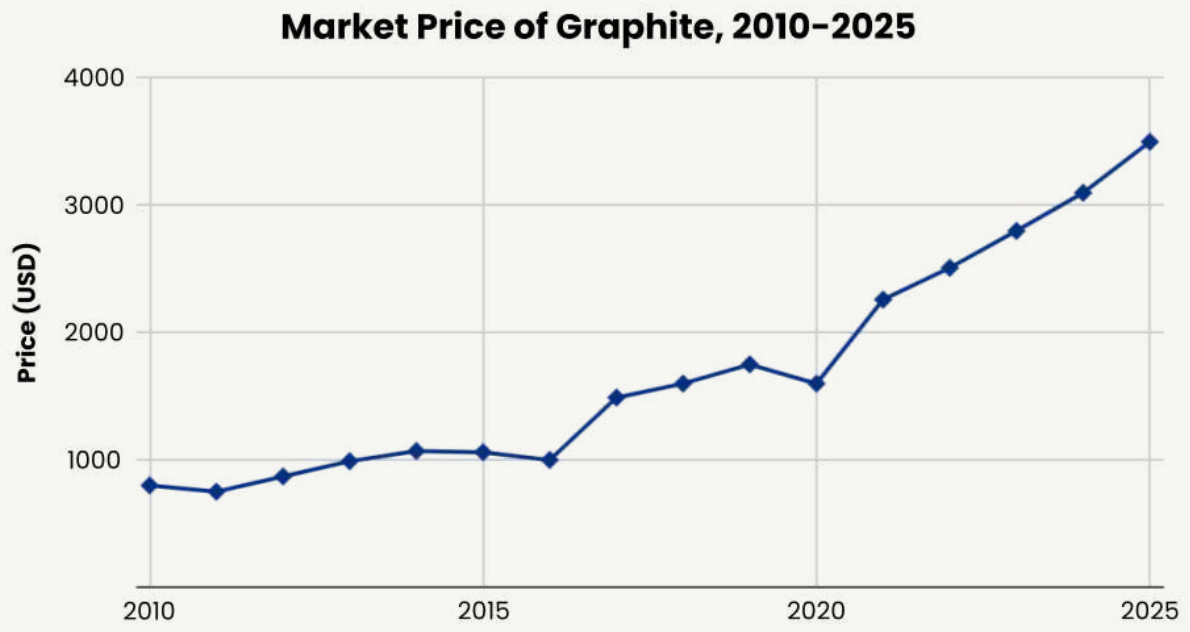
This growing strategic importance has led governments and companies alike to prioritize securing stable supplies of graphite, positioning it as beyond a mere industrial input; it is but a geopolitical asset in the clean energy transition.

Market Analysis

The price of graphite has seen sharp increases in recent years, fueled by growing global demand for electric vehicles, renewable energy storage, and other green technologies.

When your team makes your strategic analysis, it is very important for you to consider the current and future prices of graphite, *and* whether graphite can be profitably extracted for the next few years. If you advise the Brazilian government to spend hundreds of millions on building infrastructure, and the market price of graphite crashes, then the Government will make huge losses, as will the contracts of Bartley & Associates.

Graphite Market



Although graphite prices have risen sharply over the past decade, future trends remain uncertain. As with all commodities, prices will continue to be influenced by technological advancements, the emergence of new supply sources, and geopolitical developments.

What Are Other Analysts Predicting?

Analysts and industry leaders have issued a wide range of forecasts for the price of graphite at the start of 2026. Here are some representative estimates:

Silverman Bags (Investment Firm):

"We expect graphite to settle around $4,500/ton."

CEO of Graphicon (Graphite Mining Startup):

"We project graphite prices to reach around $7,000/ton."

Elena Duarte, Senior Analyst at Terranova Research:

"Our models point to a long-term average of $3,600/ton."

Arthur Ling, Commodities Desk, Altimeter Capital:

"We anticipate stabilization near $4,900/ton."

Deepika Rao, Energy Materials Analyst at Sandline Advisory:

"We're cautious and estimate a floor of $1,200/ton."

Dr. Sophia Zhang, Chief Market Strategist at NovaMetals:

"We believe graphite will average around $5,200/ton over the next five years."

As you can see, projections vary widely, reflecting the complexity and volatility of the graphite market.

Probabilistic Forecast

To help you assess potential outcomes, Bartley & Associates has prepared a simplified probability model based on a synthesis of expert projections and historical trends:

Market Price of Graphite (per ton)	Probability
$2,200	15%
$4,700	60%
$6,300	25%

This distribution reflects current market sentiment for the price of graphite in 2026: $4,700/ton is the most likely outcome, but both low and high extremes remain possible.

Assume the price observed at the start of 2026 holds steady until 2030. In other words, if the price of graphite is $4,700/ton in January 2026, assume that it will also be $4,700/ton in December 2026, January 2027, January 2028, and so on, until 31 December 2030.

Strategic Implication

As you evaluate whether Brazil should invest in extracting and exporting graphite, these price scenarios will be central to your analysis. Will your team plan conservatively and assume that you will get modest revenue? Or will your team design plans for higher returns in the hopes of capturing the upside?

The Market Demand for Graphite

Graphite is in short supply, and there is a lot of demand for it. Our experts at Bartley & Associates estimate the following unmet demand for graphite for the next 5 years.

The levels discussed below are quantities of graphite demand for which there will be **guaranteed** buyers.

For example, in 2026, Bartley & Associates expects that there will be 3.05 million tons of total unmet graphite demand. Therefore, if you choose to supply any amount less than 3.05 million tons in 2026, you are guaranteed to sell all your stock. If you choose to produce more than 3.05 million tons, then you will have to wait till 2027 to sell your excess stock.

Bartley & Associates' experts are uncertain about the demand for graphite beyond 2030. For your analysis, assume that you will only be able to sell graphite until 2030 at the quantities illustrated below.

Unmet Demand for Graphite by Country (millions of tons)					
Country	**2026**	**2027**	**2028**	**2029**	**2030**
China	1.80	2.00	2.20	2.40	2.60
United States	0.50	0.60	0.70	0.80	0.90
India	0.30	0.35	0.40	0.45	0.50
Germany	0.20	0.25	0.30	0.35	0.40
South Korea	0.15	0.20	0.25	0.30	0.35
Japan	0.10	0.15	0.20	0.25	0.30
Total	**3.05**	**3.55**	**4.05**	**4.55**	**5.05**

The Cost of Graphite

Before you can begin transporting or selling graphite, your team must first decide how much of it to mine. Our analysis estimates that mining operations will face economies of scale. Economies of scale mean the more graphite you extract, the cheaper the cost per ton becomes.

Quantity Mined (tons)	Price per Ton
500,000	$1000
3,000,000	$800
14,000,000+	$400

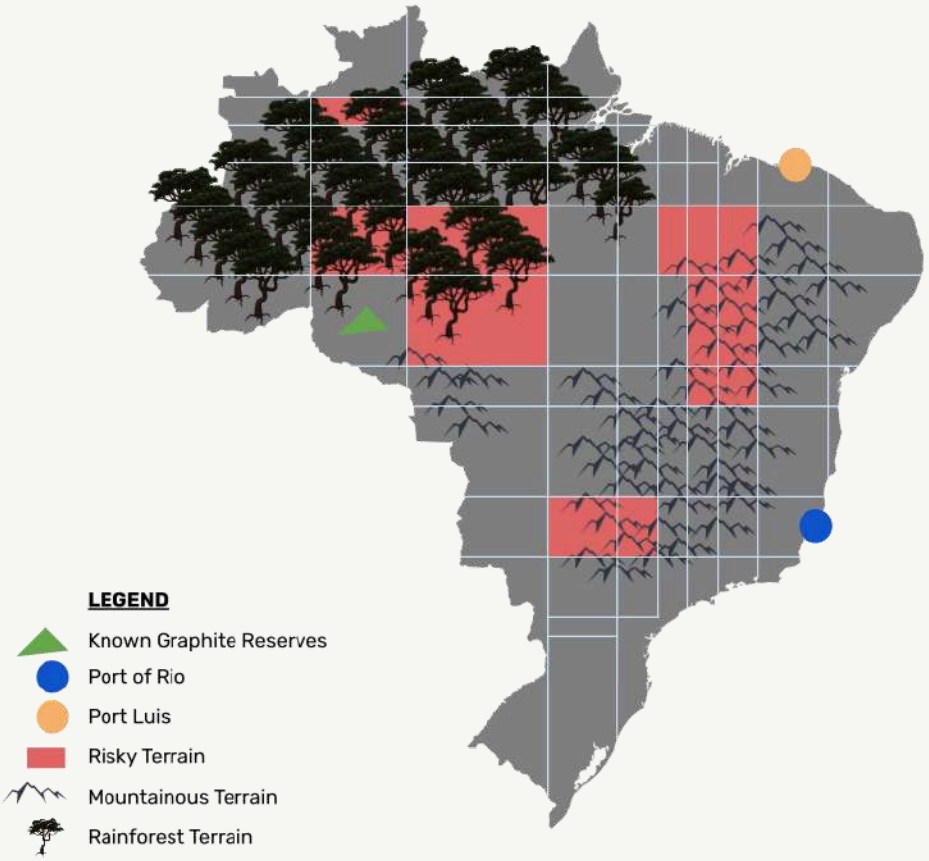
Each quantity option comes with different implications for the business model that your team could recommend. With larger volumes comes greater responsibility: you may need to build more capital-intensive infrastructure, such as rail lines or port upgrades.

Choose wisely: your decision will define the scale, structure, and ambition of your entire operation.

Section 3: Transportation Rules

To make an informed recommendation, you'll need to carefully consider geography, infrastructure, and access routes. In this section, our experts at Bartley & Associates have created a docket with key pieces of information. Each piece of information is referred to as an 'asset'.

Asset #1: Topographical Map of Brazil



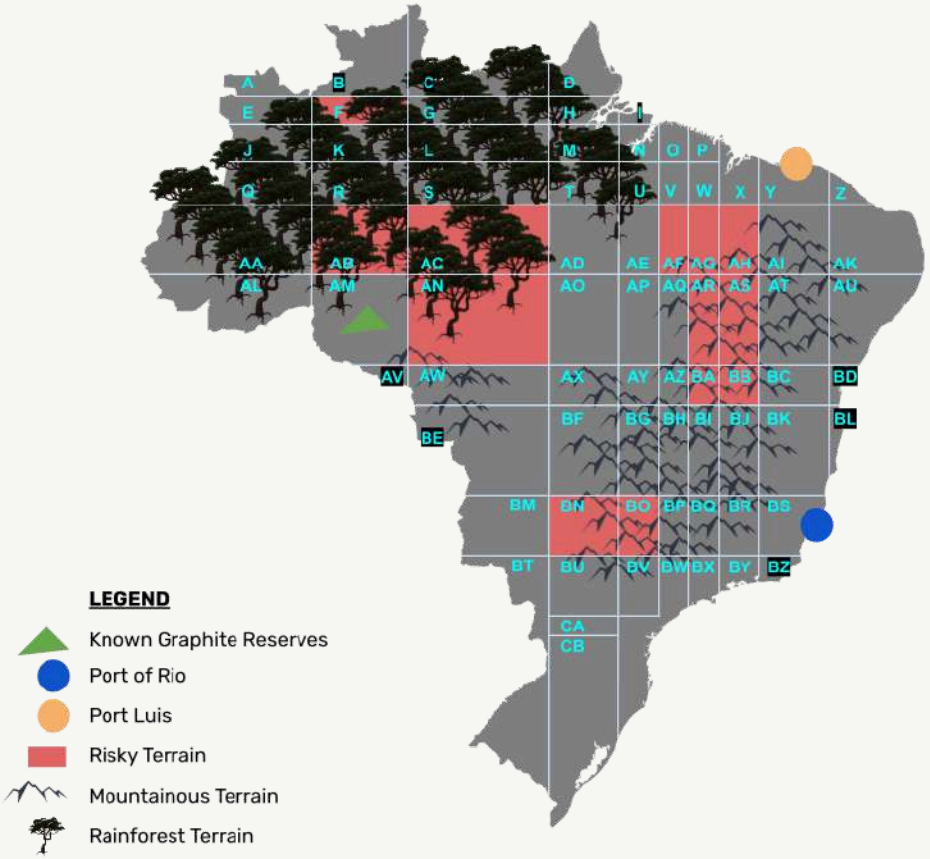
Our experts at Bartley & Associates have created a map of Brazil to help you plan.

The country is divided into areas called *Regions*. There are three types of regions:

- **Rural Region**: Rural regions have rainforest terrain, represented by a tree icon. If a region has even 1 single pixel of a tree icon, it is deemed to be a rural region.
- **Mountainous Region**: Mountainous regions have mountainous terrain, represented by a mountain icon. If a region has even 1 single pixel of a mountain icon, it is deemed to be a mountainous region.
- **Urban Region**: Regions that do not have any icons are developed areas and deemed to be urban regions.

Different types of regions affect how expensive it is to build or travel through. Use this map to help you decide the best route for your plan.

Asset #2: Transportation Logistics



For your convenience, our experts at Bartley & Associates have codified each region with an alphabetic code, from A to CB.

The only way to export and sell graphite to foreign buyers is to deliver the graphite to a port. Therefore, your team must devise a route to transport graphite from Region AM to an acceptable port.

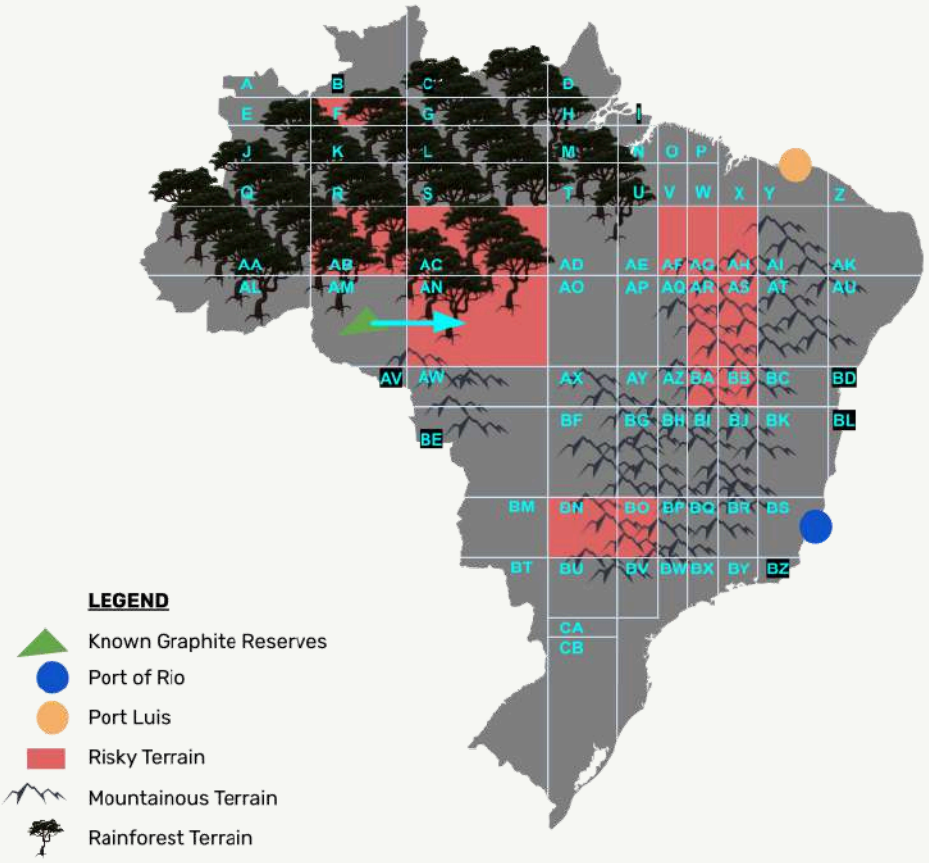
The **rules for transportation** are simple:

1. Moving goods from one region to a neighboring region incurs transportation costs.
2. If your route passes through a region, you must pay the transportation fee for that region.
3. It takes 1 day to traverse a region.

The more regions your route passes through, the higher the total cost. Therefore, one of your team's **objectives** is to identify an efficient transportation plan.

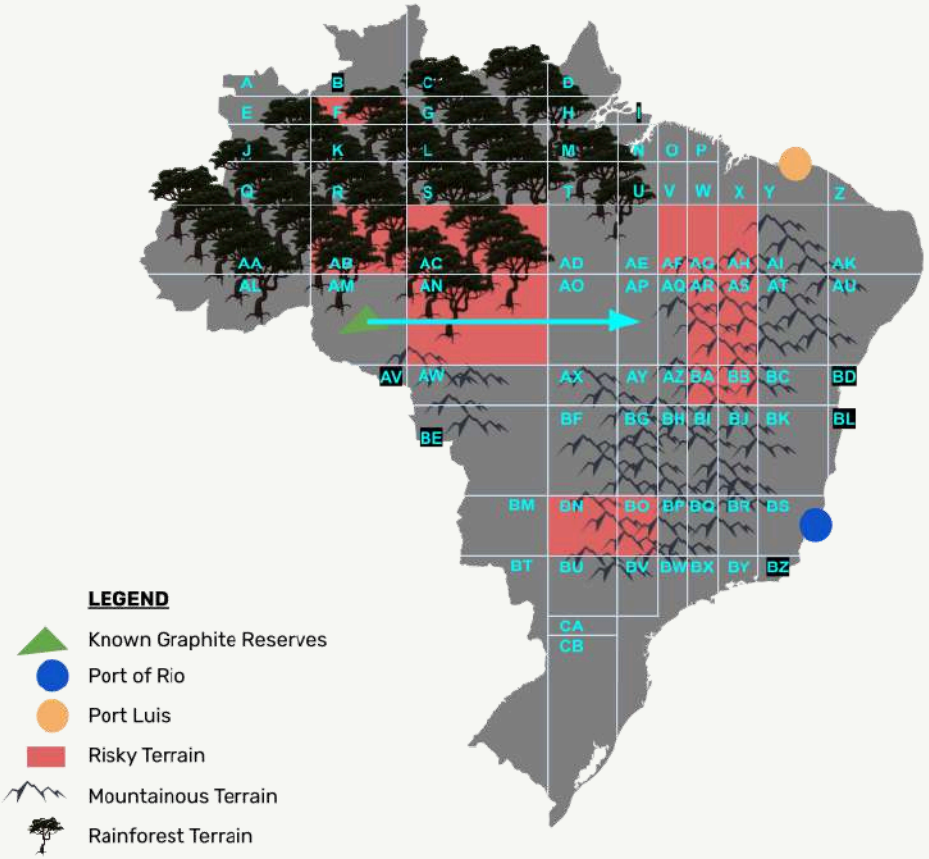
Asset #2: Transportation Logistics, *Worked Examples*

Worked Example 1



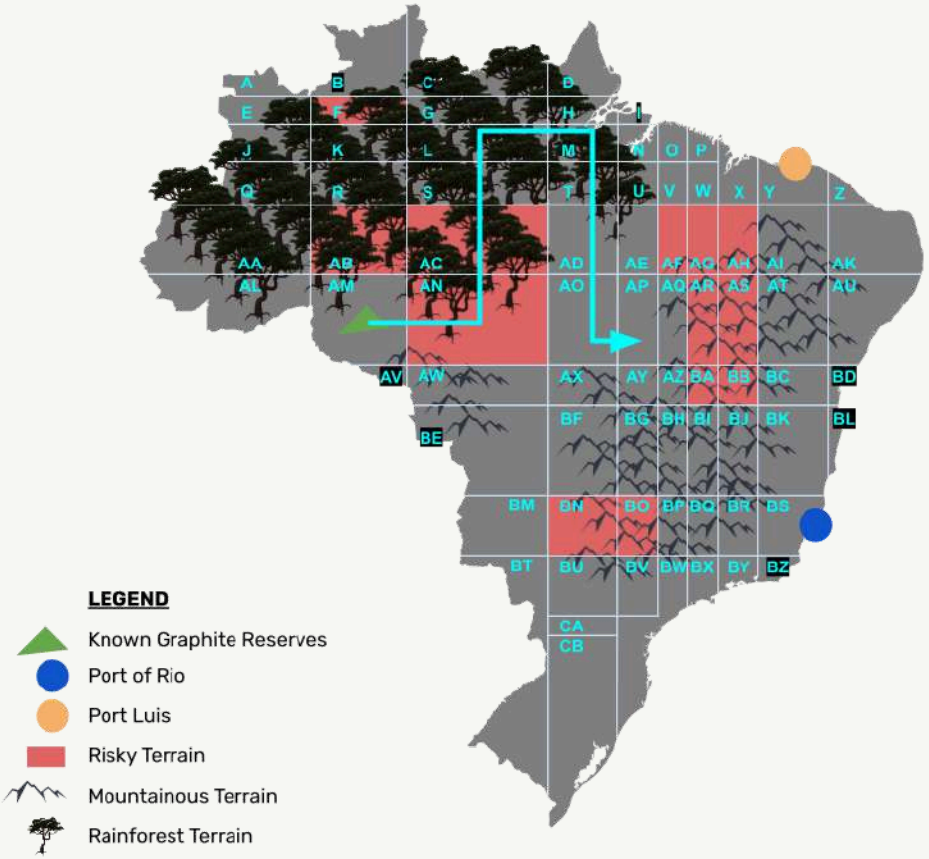
Suppose you are transporting graphite between Region AM and Region AN. You would incur transportation costs in both Region AM and Region AN. Your journey would take 2 days.

Worked Example 2



Suppose you are transporting the graphite between Region AM and Region AP. You would incur transportation costs in Regions AM, AN, AO, and AP. Your journey would take 4 days.

Worked Example 3



Suppose you are transporting the graphite between Region AM and Region AP. You would incur transportation costs in Regions AM, AN, AC, S, L, M, T, AD, AO, and AP. Your journey would take 10 days.

Section 4: Infrastructure

Infrastructure

To extract and export Brazil's graphite resources, the government must invest in infrastructure that can handle the movement of heavy materials across challenging terrain.

As consultants at Bartley & Associates, one of your team's **objectives** is to assess the costs and benefits of different transportation options: roads, railroads, and ports.

Road Networks

Urban regions already have high-quality, heavy-duty roads that are suitable for transporting large quantities of minerals using trucks.

However, rural and mountainous regions **do not** have the necessary high-quality roads. To make these areas usable for mineral transport, the government would have to invest in new road networks.

<u>Construction Costs for Road Networks:</u>

- Rural Region: $100 million per region
- Mountainous Region: $200 million per region



Railroads

You might recommend that the Brazilian government invest in railroads as a cheaper, long-term way to move graphite around the country. Trains can carry more at a lower cost over time, but building the rail lines has a significant upfront cost.

You may build two types of railroads: standard railroads and electrified railroads.

Railroads, Standard

In standard railroads, you may only operate diesel trains.

Construction Costs for Standard Railroads:

- Urban Region: $100 million per region
- Rainforest Region: $250 million per region
- Mountainous Region: $400 million per region

Railroads, Electric

You may recommend building *electrified* railroads. In electrified railroads, you may operate both diesel trains and electric trains.

Compared to standard rail, electric rail produces lower carbon emissions, less noise, and minimal air pollution. In fragile rainforests and mountainous areas, these sustainability benefits may make electrified rail a more responsible investment.

However, environmental responsibility comes at a steep economic price. The construction costs of building an electrified railroad are **double** the costs of building a standard railroad in every region. For example, a standard railroad that costs $250 million in a rainforest region would cost $500 million if electrified.

Environment or profits? It's up to you to balance your priorities in this project, and your team must decide what trade-offs you are willing to make.

Ports

To export graphite to foreign countries, the minerals must be transported to a port and shipped from there. Efficient port access is essential to any export strategy.

Our experts at Bartley Associates have identified two potential options.

Port of Rio, Rio de Janeiro

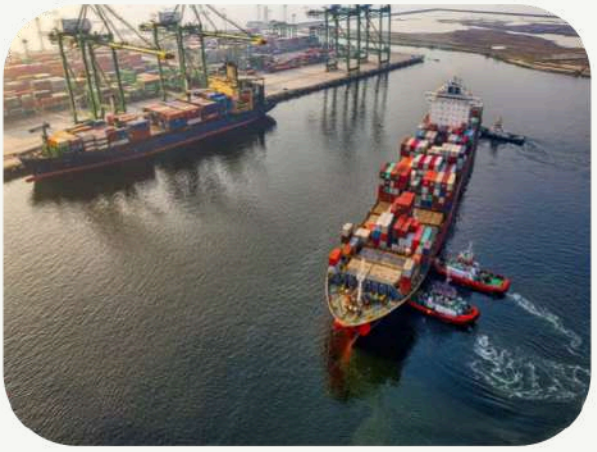
The Port of Rio is a deep-water port, which means it can accommodate large, heavy cargo ships that can carry graphite in bulk. Deep water ports are equipped with the necessary infrastructure required to load minerals efficiently onto international vessels, including deep docking areas, large cranes, and container handling systems.

Port Luis, Northern Brazil

Port Luis is a shallow-water port, which does not have the depth or infrastructure to support large vessels used in international shipping. As it stands, this port **can not** be used to export graphite.

However, it can be upgraded into a deep water port at a **one-time cost of $2 billion**. This upgrade would include dredging the harbor, strengthening docks, and installing equipment capable of handling bulk minerals like graphite.

Remember: only deep water ports can be used to export graphite to other countries. As part of your team's **objectives**, your logistics plan must ensure that graphite gets transported to the relevant port so that it can be exported to foreign buyers.



Section 5: Transportation Costs

Transportation Costs

To deliver graphite across Brazil, you must choose what types of vehicles to use. Each vehicle has different costs, capacities, and limitations.

When you decide the quantity of graphite that you want to extract, make sure that you purchase enough vehicles so that you have the capacity to transport the graphite from the mine to the port.

All vehicles are a one-time upfront purchase.

Remember: vehicles can only be used if the right infrastructure is already in place. For example, you cannot operate a truck in a region unless you've already invested in a road network there.

Don't forget: one of your team's **objectives** is to assess the costs and benefits of different transportation options: roads, railroads, and ports.

Road Vehicles

Road Vehicles, Diesel Trucks

Diesel trucks are the most affordable option to purchase. Each diesel truck costs $200,000 and can carry 30 tons of graphite. However, they have higher operating costs.

Operating Costs by Region:

- Urban Region: $100 per ton
- Rainforest Region: $200 per ton
- Mountainous Region: $300 per ton

Road Vehicles, Electric Trucks

Electric trucks are more expensive to purchase, costing $400,000 each. They carry up to 20 tons, as part of their load capacity is taken up by heavy batteries used to power them. However, electric trucks are cheaper to operate than diesel trucks.

Operating Costs by Region:

- Urban Region: $70 per ton
- Rainforest Region: $140 per ton

Note: Electric trucks cannot be used in mountainous regions as they have hardware limitations. They do not have the torque required to handle steep slopes.

Rail Vehicles

Rail Vehicles, Diesel Trains

Diesel trains are relatively cheap to buy, costing $15 million each. They have a high capacity: one train can carry 12,000 tons. Diesel trains can run on any type of rail, regardless of the region.

Diesel trains have a special benefit: the cost to operate a diesel train will always be $50/ton, regardless of whether the train is operating in an Urban Region, a Rainforest Region, or a Mountainous Region.

Rail Vehicles, Electric Trains

Electric trains are more expensive, with each train costing $25 million. They, too, can carry 12,000 tons. But they are significantly cheaper to operate if the infrastructure is in place.

Like diesel trains, electric trains have a uniform cost of transportation across every region. However, electric trains are much cheaper: the cost to operate an electric train is $20/ton.

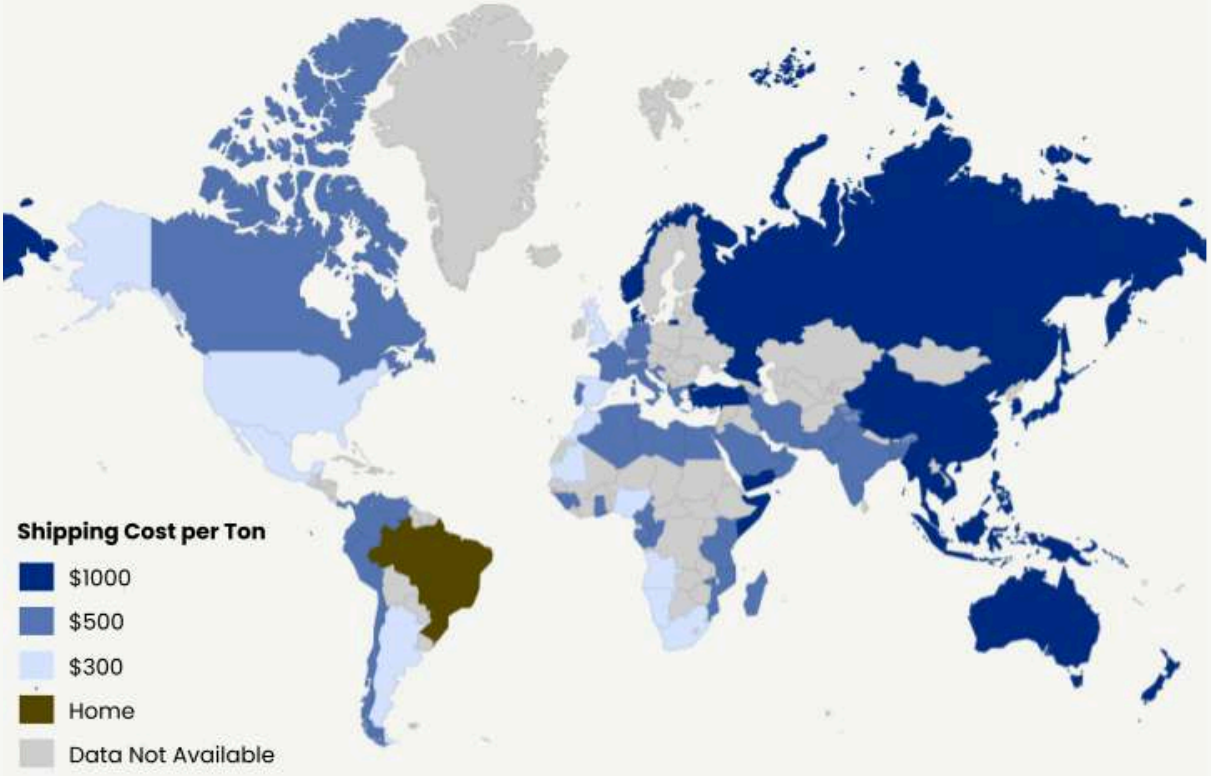
Note: Electric trains can only operate on electrified railroads. Remember, electrifying a railroad doubles its construction cost. Plan your routes and infrastructure accordingly.

Shipping

Once your graphite reaches a port, it can be exported internationally. There are no capacity limits on how much graphite can be shipped.

The international shipping cost (per ton) is provided separately on the shipping cost map below.

You do **not** need to purchase any ships to make international shipments.



Handling Fee

Whenever graphite changes its mode of transport, you must pay a handling fee of $50 per ton.

This fee applies when graphite is transferred:

- From road to rail, or
- From rail to ship, or
- From truck to ship, or
- Any vice versa combination

However, you will not be charged a handling fee if graphite only changes between vehicles of the same type.

As examples:

- Going from a diesel train to an electric train (same mode = no fee)
- Going from a diesel train to a diesel truck (different mode = fee applies)

Use this information to plan a transport system that balances cost, efficiency, and infrastructure availability. The right combination of vehicles and routes could mean the difference between a profitable project and a loss-making one.

Section 6: Security Risks

Security Risks

Unfortunately, several parts of Brazil are currently affected by insurgency movements. These areas are highlighted in red and marked as 'Risky Terrain' in the map in Asset #1.

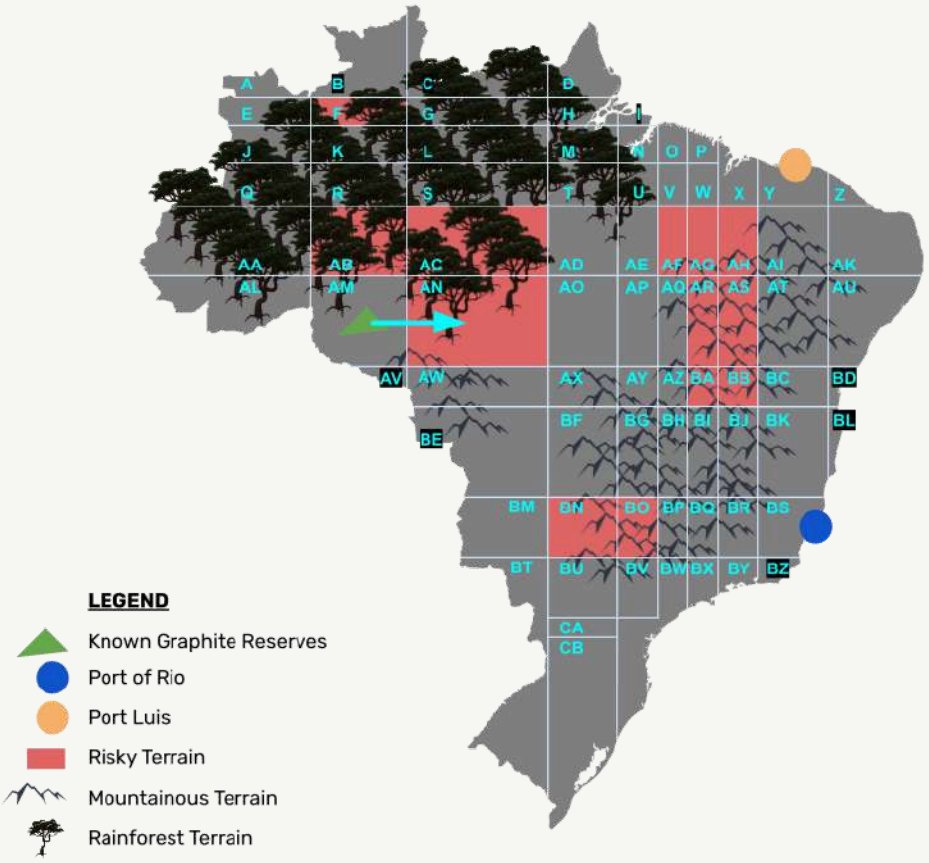
Risky regions pose a significant risk to transporting high-value goods like graphite.

According to estimates from our partners at the Oxford Finance Society, each risky region that your transport route passes through has a 3% spoilage rate. That is to say, if your transport route passes through a risky region, 3% of the capacity of graphite being transported via that route will be stolen.

This risk is cumulative: for every additional risky region that your transport route goes through, an additional 3% of the total capacity of graphite transported via the *entire* route will be stolen.

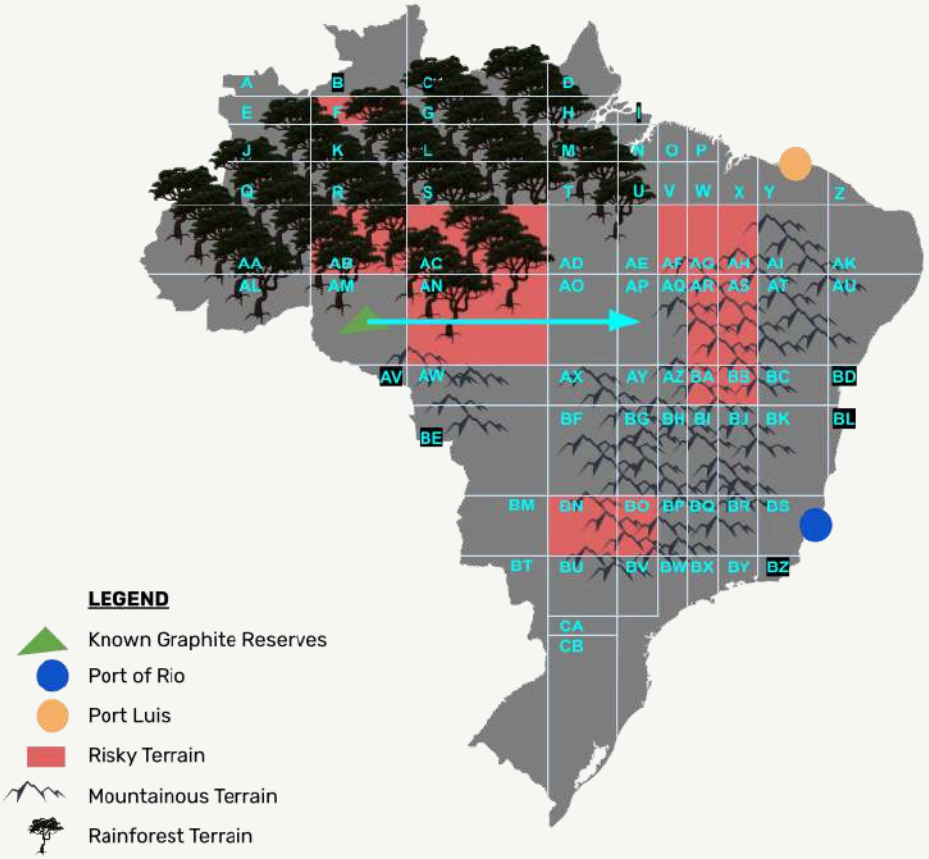
Asset #3: Security Risks, *Worked Examples*

Worked Example 1



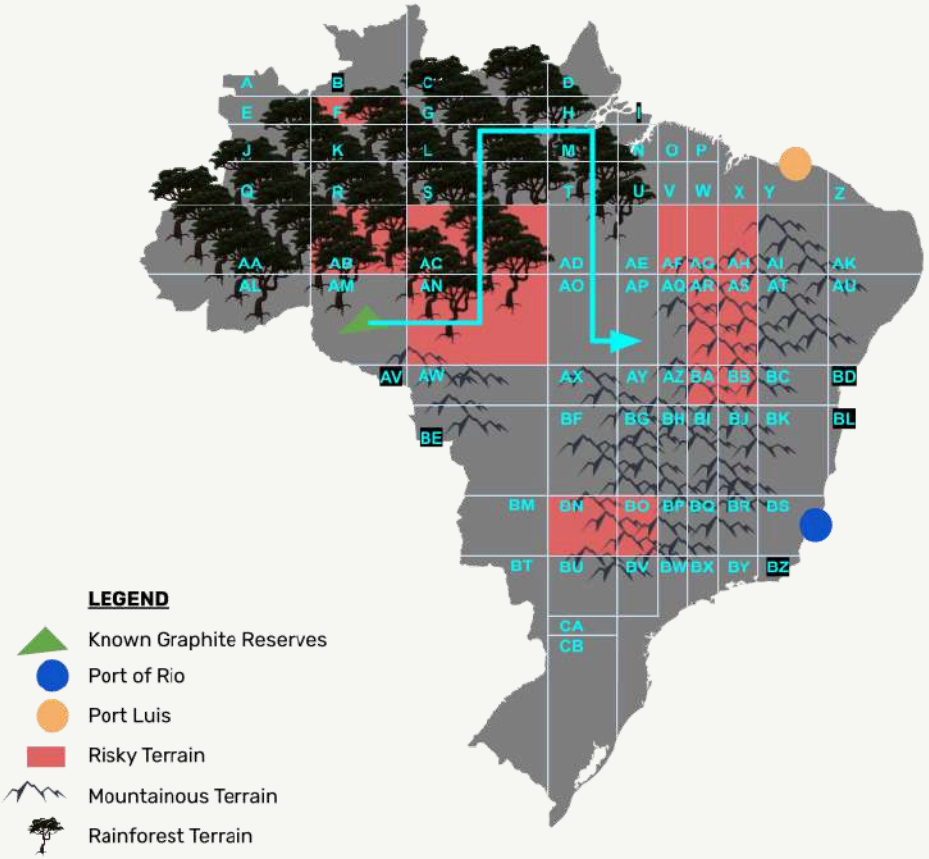
Suppose you are transporting the graphite between Region AM and Region AN. You would take a 3% loss on total revenue earned, as your route passes through Region AN, which contains risky terrain.

Worked Example 2



Suppose you are transporting the graphite between Region AM and Region AP. You would take a 3% loss on total revenue earned, as your route passes through Region AN which contains risky terrain.

Worked Example 3



Suppose you are transporting the graphite between Region AM and Region AP. You would take a 6% loss on total revenue earned, as your route passes through Region AN and Region AC, both of which contain risky terrain.

Managing Security Risks

Our experts at Bartley & Associates have suggested three possible options to manage the security risks of transporting graphite. Your team may accept either of these options or come up with your own idea.

Avoid Dangerous Routes

You may choose to completely avoid risky regions in your route planning. This ensures 0% risk of theft, but may require longer or more expensive routes.

Hire Specialized Private Security

You may hire private security teams to accompany your graphite shipments through risky regions. This will eliminate the risk of theft entirely. However, doing so increases your transportation costs by 15% per risky region.

For example, if transporting graphite by truck costs $100/ton in a risky region, hiring private security increases the cost to $115/ton in that specific region.

Similarly, if transporting graphite by electric train costs $20/ton in a risky Region, hiring private security increases the cost to $23/ton in that Region.

Insure Your Losses

You may choose to insure your shipments. This means you'll be fully reimbursed for any losses due to theft. The cost of this insurance is 1% of the revenue earned from selling the graphite.

This option protects your top line, but adds a cost directly tied to how much you sell.

When planning your transportation strategy, remember: every risky region that your transportation route passes through introduces risk and/or added cost. One of your team's **objectives** is to find a balance between safety, profitability, and efficiency.

Section 7: Environmental, Social, and Governance Risks

Environmental, Social, and Governance Risks

Extracting graphite at scale will not come without consequences. Some rivers may be polluted. Sections of forests will be cleared. Local communities, including Indigenous populations and farming families, could face displacement, reduced access to natural resources, or long-term economic setbacks.

Yet, the same graphite may help power a global shift toward electric vehicles, significantly reducing long-term global carbon emissions. The environmental and social costs will be concentrated in specific regions of Brazil, while the environmental benefits will be more widely distributed and more delayed.

This raises a fundamental ethical and strategic question: **how do you weigh significant local harm against broader global good?**

There is no single correct answer. As consultants, you are expected to recognize these trade-offs and consider how they factor into your final recommendation, not just in terms of economics, but in terms of long-term impact and responsibility.

Section 8: Your Team’s Strategic Recommendation

Your task is to develop a full business plan for extracting, transporting, and selling graphite. Your plan should answer the following 2 questions:

1. **Is it profitable to sell graphite under your model? What is the profit we can make under your plan in the next 5 years?**

2. **What is your operational model for extracting and transporting the graphite from the mine site to the relevant port?**

This plan should be grounded in the information we have given you, and your submission may include answers to the following questions:

1. **Choice of Purchase Contract**
- What quantity will you commit to, and why?
- How does your choice affect your infrastructure needs?

2. **Infrastructure Development**
- Will you build roads, rail, or ports? Electrify rail?
- Where will your transport routes go, and what regions will they pass through?

3. **Transportation Plan**
- What vehicles will you use? Trucks? Trains? Electric or diesel?

4. **Cost Breakdown**
- What are the estimated costs of your proposal, both in one-time purchases and total operating costs?
- What are the total costs of your operation from 2026 to 2030?
- Are you using any assumptions in your methodology?

5. **Revenue Estimates**
- How much quantity of graphite do you expect to sell? What do you believe the market price of graphite will be, and how do you factor in the various scenarios in your analysis?

6. **Risk Management**
- What risks do you face? (e.g. market volatility, insurgent regions, environmental backlash)
- How do you mitigate or account for these risks?

7. **Environmental, Social, and Governance Concerns**
- Are there trade-offs between local environmental harm and global environmental gains? If so, will your strategy address or mitigate these concerns?

Note: For the purposes of this case study, assume inflation does not exist.

Submission Guidelines

Your team's submission may be one of the following options:

1. A video (maximum 5 minutes long)
2. A podcast (maximum 10 minutes long)
3. A presentation (maximum 10 slides)
4. An essay/report (maximum 1,000 words)

Alongside your submission, your team may submit an appendix showing your methodology and worked solutions.

Note: If your team does choose to submit an appendix, please make sure that it is structured in a coherent manner and easy to follow.

Judgement Criteria

There truly is no single correct answer. Your team may find that a modest, low-risk operation is more reliable than a bold, high-risk investment. Or your team may choose to go big, confident in your long-term infrastructure and market outlook.

In fact, your team may even find that it is not possible to make a profit in any scenario, and you may even recommend that the Brazilian government extract 0 tons of graphite.

Whatever your answer is, make sure it's grounded in logic and data. Best of luck.

Below are the criteria we will use to mark your submission. Our scoring system includes a carefully designed grading coefficient so every submission will be assessed in context to assure fairness.

Quantitative Performance (Overall Profit / Loss)

Teams with the highest total profit or return on investment will be given higher marks.

Feasibility

Teams that provide solutions that do not break the constraints of the case study will be given higher marks.

Communication Skills

Teams that structure their communication and engage the audience through confident delivery will be given higher marks.

Reasoning Skills

Teams with logical, data-based solutions with clear justification of choices and assumptions will be given higher marks.

Technical Skills

Teams with a high quality of submission (e.g. essay without any typos, video in 720p or better quality, podcast with clear audio, etc) will be given higher marks.

Risk Management

Teams that show awareness of potential downsides and include strategies to manage uncertainty will be given higher marks.

Creativity and Innovation

Teams that introduce original or unconventional ideas that add significant value without sacrificing feasibility will be given higher marks.