

| VOL. 3 | SEPTEMBER 2025 |

PERSPECTIVE

PORT LOGISTICS

COMPLEXITY OF

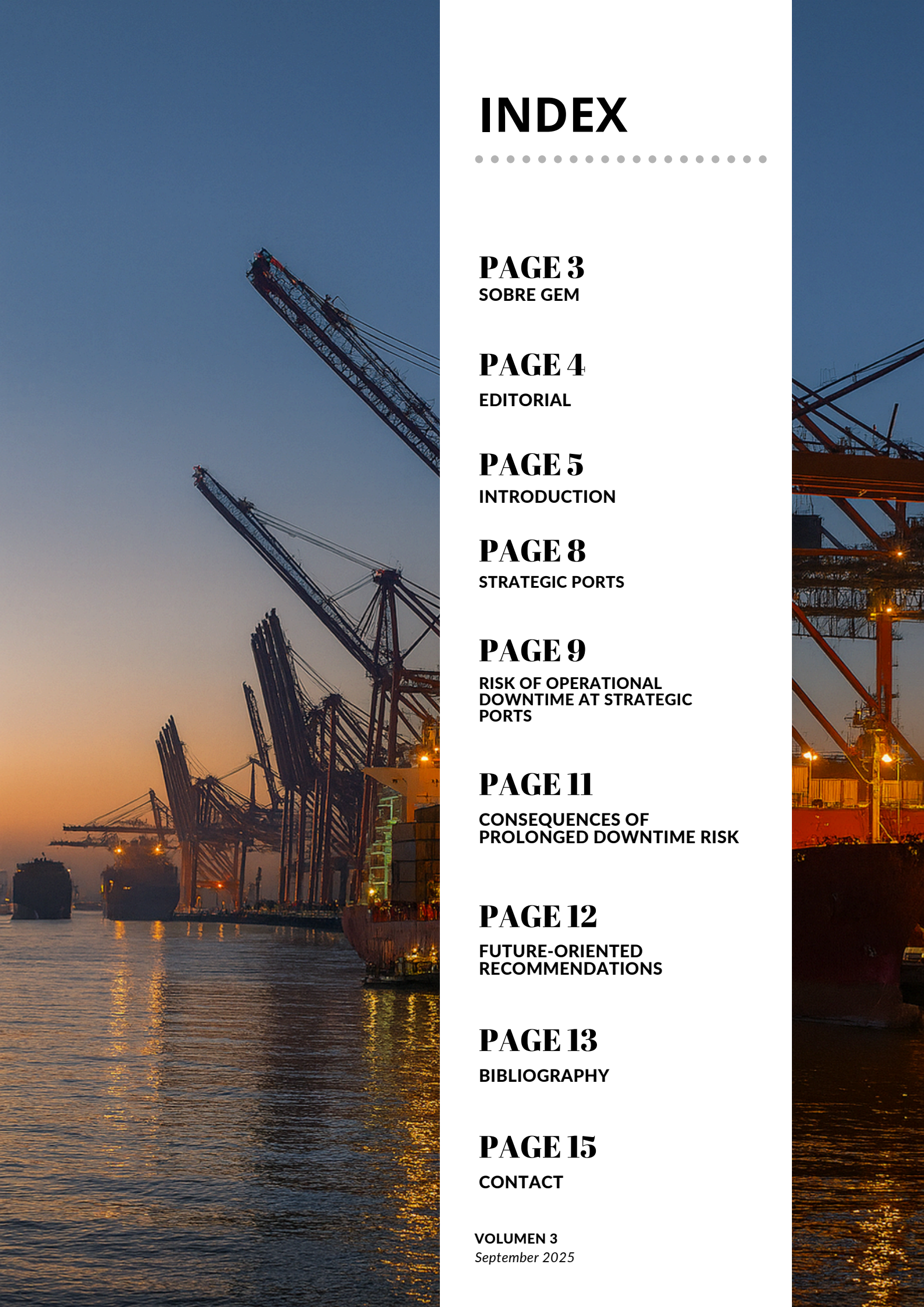
COPPER

OPERATIONAL AND STRATEGIC

RISKS



Paving the way for the future of mining



INDEX

PAGE 3
SOBRE GEM

PAGE 4
EDITORIAL

PAGE 5
INTRODUCTION

PAGE 8
STRATEGIC PORTS

PAGE 9
RISK OF OPERATIONAL
DOWNTIME AT STRATEGIC
PORTS

PAGE 11
CONSEQUENCES OF
PROLONGED DOWNTIME RISK

PAGE 12
FUTURE-ORIENTED
RECOMMENDATIONS

PAGE 13
BIBLIOGRAPHY

PAGE 15
CONTACT

VOLUMEN 3
September 2025

ABOUT

G

E

M

We are an Industrial Engineering company specialized in supporting the mining industry in management and economic matters. With over **16 years of experience** and the successful implementation of more than **500 projects worldwide**, we stand out for our strong track record and commitment to excellence in the sector.

GEM leads the future of mining with innovative solutions.

From climate change management to deep-sea mining and in-situ leaching, GEM is committed to promoting sustainable, collaborative, and responsible practices, always with a focus on social and environmental impact.



Climate Change



Collaboration



Data Science



Decarbonization



Deep Sea Mining



In Situ Leaching



Nature



Social Impact
Assesment



Space Mining



EDITORIAL

BY ISAAC PAREDES PRACTICE LEADER EVALUATION

In modern mining, producing is not enough: ore must be moved in a timely, efficient, and competitive manner. In a country like Chile, where more than 90% of mining products are exported by sea, port logistics are no longer an externality but a central component of the sector's competitiveness. This issue of *Perspectiva* focuses on a phenomenon that has shifted from being an operational concern to becoming a true strategic factor: port logistics bottlenecks. Through quantitative analyses, regulatory reviews, and international comparative studies, the document examines how restrictions in port capacity, dependence on private services, and weak inter-institutional coordination affect copper export costs and timelines, compromising the efficiency of the entire mining value chain.

The study highlights three key dimensions: the concentration of supply in a few terminals, the lack of multipurpose infrastructure, and regulatory challenges that limit long-term investment and planning. It also points out the differences between Chile and other exporting countries such as Peru and Australia, where institutional frameworks foster greater resilience and logistical flexibility.



At GEM, we believe that addressing these challenges requires more than infrastructure: it calls for governance, Risk Analysis, and strategic vision. The transition toward a more resilient and competitive mining sector depends on integrating port logistics as a critical variable in project evaluation and planning. With data-driven solutions, simulation, and collaboration between public and private stakeholders, it is possible to turn a structural constraint into an opportunity for systemic improvement.

INTRODUCTION

Copper plays a strategic role in the global economy and in national security. Recently, the U.S. Government proposed including it on the list of critical minerals for 2025, highlighting its importance in sectors such as transportation, defense, power grids, and data centers—particularly in light of the growth of artificial intelligence (Reuters, 2025; U.S. Department of the Interior, 2025).

At the same time, this growing relevance is strained by the vulnerability of supply chains. Without actions to expand production, global copper supply is projected to face a 30% shortfall compared to demand by 2035 (International Energy Agency, 2025).

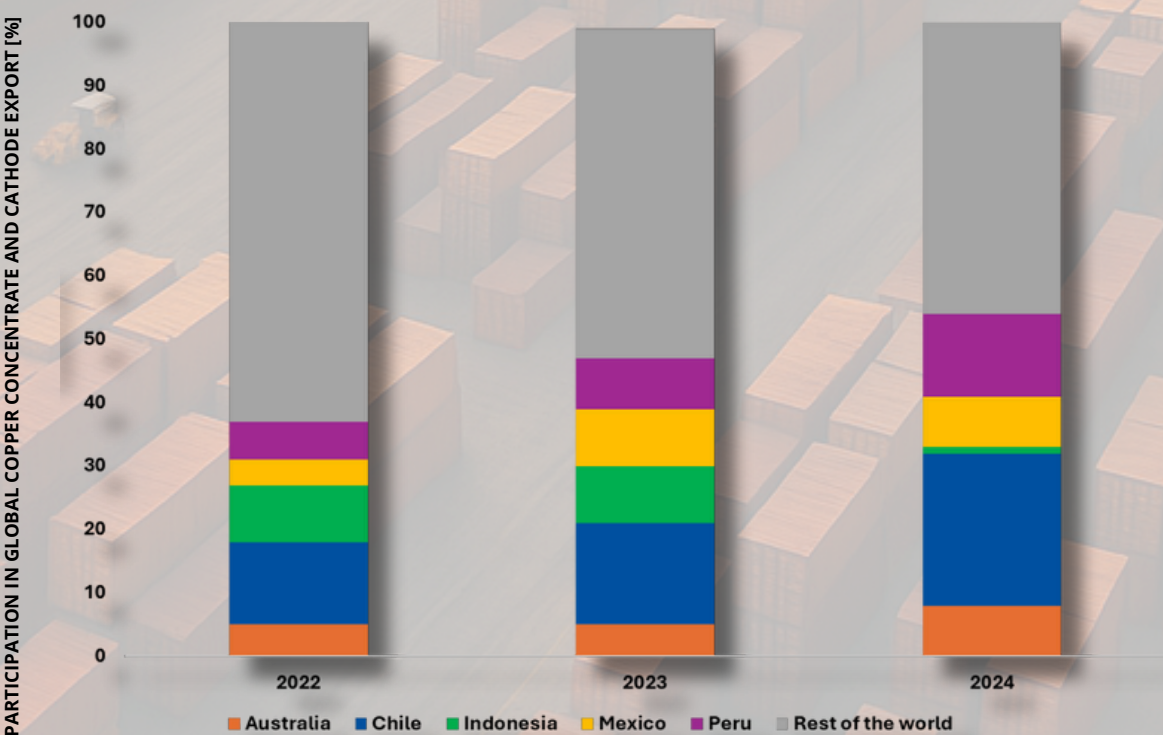
Chile is positioned as the world's leading producer of this mineral, with exports exceeding 5 million tons of contained copper annually (United States Geological Survey, 2025). More than half of this volume corresponds to copper concentrate and the remainder to cathodes, with Asia as the main destination (Chile Customs, 2024; International Copper Study Group, 2024).

Until 2022, Peru ranked second globally in copper production, with an average of around 2.5 million tons of contained copper per year (United States Geological Survey, 2024). However, from 2023 to the present, the Democratic Republic of Congo has taken second place, with approximately 3 million tons annually (United States Geological Survey, 2025). Australia, although more diversified in commodities such as coal, iron, and bauxite, is also a key copper player. Mexico, while not reaching the volumes of Chile and Peru, leads production in North America, with operations concentrated in the state of Sonora.

Indonesia, for its part, was for decades a major exporter of concentrates. In 2021, it shipped 2 million tons of contained copper (World Integrated Trade Solution, 2025), but since 2023 the country has prohibited the export of unprocessed minerals (Reuters, 2024). As a result, it has promoted the construction of smelters and refineries, so that copper is now processed locally before being exported as refined metal.

In this context, port logistics becomes essential, since an extreme event that could cause the closure of a port for an indeterminate period would restrict the production of copper concentrates and cathodes. It should be noted that around 80% of world trade is transported by sea, making ports strategic nodes for connecting mining production with international markets (World Trade Organization, n.d.). Between 2022 and 2024, Chile led global exports of concentrates and cathodes with a 17% share, followed by Peru (9%), Mexico (7%), and Australia together with Indonesia (6%) (United Nations, 2025). Although the Democratic Republic of Congo is one of the main exporters, it is not included in the port analysis because it has no seaports of its own, exporting instead through neighboring countries such as South Africa (Durban Port), Tanzania (Dar es Salaam Port), and Angola (Lobito Port), among others (Mining Weekly, 2024; The Northern Miner, 2024). Thus, from 2022 to 2024, these countries contributed between 36% and 54% of total world exports (Figure 1).

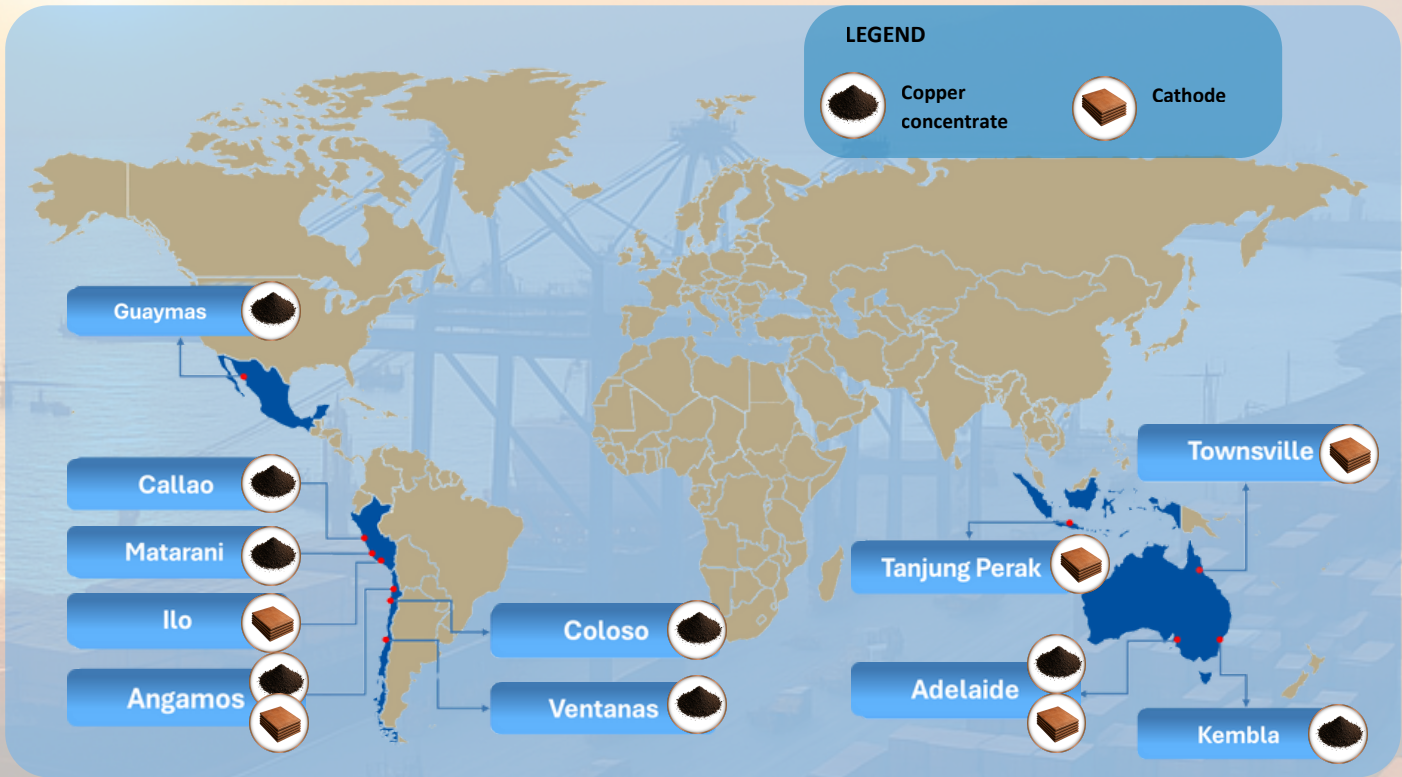
FIGURE 1. SHARE OF LEADING COUNTRIES IN GLOBAL EXPORTS OF COPPER CONCENTRATES AND CATHODES, 2022–2024



The main ports supporting these exports are: Angamos, Coloso, and Ventanas in Chile; Matarani, Callao, and Ilo in Peru; Guaymas in Mexico; Adelaide, Townsville, and Kembla in Australia; and Tanjung Perak in Indonesia (**Figure 2**).

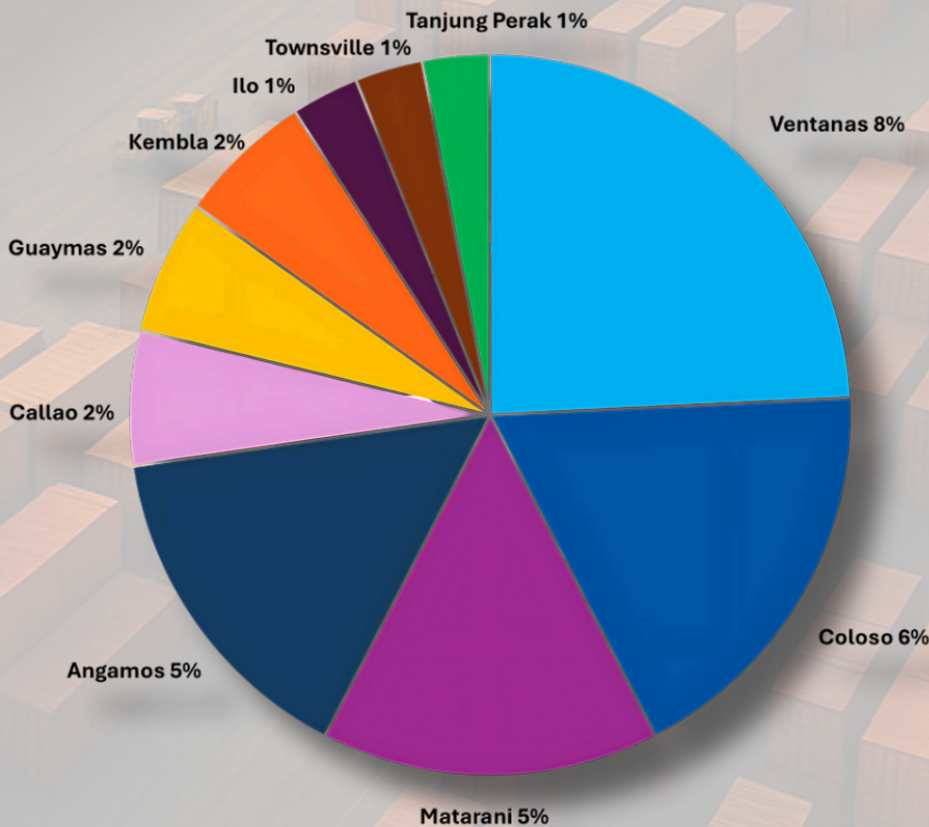
In 2024 alone, 33% of the world's copper in the form of concentrate and cathode was shipped through these ports. Among them, Angamos, Coloso, Ventanas, and Matarani stand out, accounting together for 24% of global exports (**Figure 3**).

FIGURE 2. KEY PORTS OF LEADING COPPER CONCENTRATE AND CATHODE EXPORTING COUNTRIES



Source: own elaboration

FIGURE 3. DISTRIBUTION OF COPPER EXPORTS (33% OF GLOBAL TOTAL) IN 2024 VIA KEY PORTS

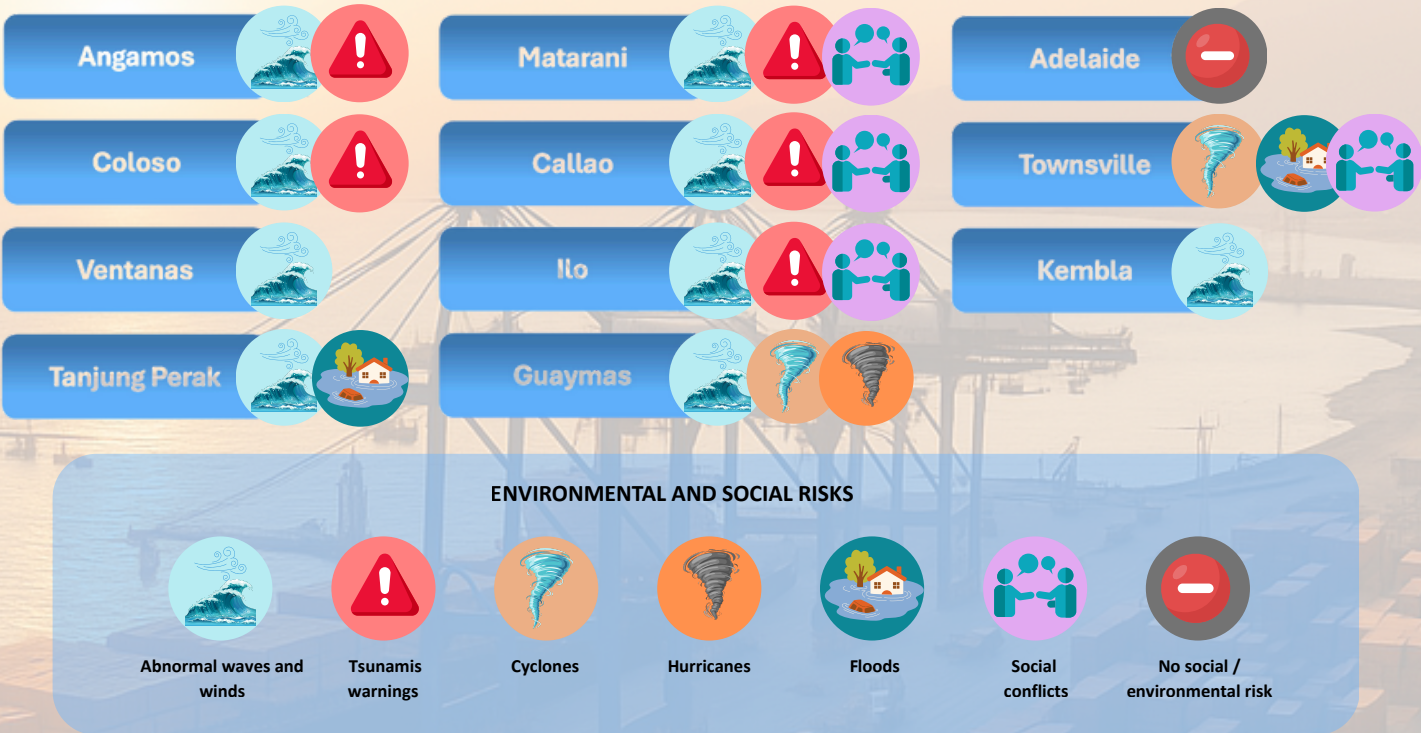


Source: own elaboration

However, this system faces increasing risks driven by climate change. Phenomena such as abnormal swells, cyclones, hurricanes, and coastal flooding cause disruptions in port operations (**Figure 4**).

It is estimated that these phenomena, which generate periods of downtime in ports, threaten around 81 million dollars of global trade and at least 122 million dollars in economic activity per year (Verschuur et al., 2023).

FIGURE 4. MAIN ENVIRONMENTAL AND SOCIAL RISKS OF PORTS



Source: own elaboration

In South America, swells are recurrent and lead to temporary closures for safety reasons. In January 2025, for example, Puerto Angamos suspended the arrival of two container vessels due to abnormal waves (PortalPortuario, 2025). In Peru, in May of the same year, more than 80 ports were preventively closed for four days for the same reason (Ezerskii, 2025).

In the Northern Hemisphere, tropical cyclones constitute the main threat. In September 2024, Tropical Storm Ileana paralyzed ports in the Gulf of California, Mexico, for two days (Uniradio Informa, 2024). Australia, located in the Southern Hemisphere, also faces cyclones regularly, especially along its northern coast; the port city of Townsville records on average two events per season (Port of Townsville, 2020). In Southeast Asia, Indonesia mainly experiences coastal flooding associated with rising sea levels. In April 2025, exceptionally high tides flooded low-lying areas of Surabaya (Devi, 2025).

In addition to these climate-related risks, social conflict also plays a role. In Peru, for example, protests against the Tía María project in 2019 led to blockades and stoppages that affected port operations (Semana Económica, 2019). Given this scenario, it is critical to analyze the vulnerability of key copper supply chain ports to climate and social threats. This study focuses on Angamos, Coloso, Ventanas (Chile), and Matarani (Peru)—responsible for 24% of global exports—describing their operations and assessing their exposure to risks.



STRATEGIC PORTS

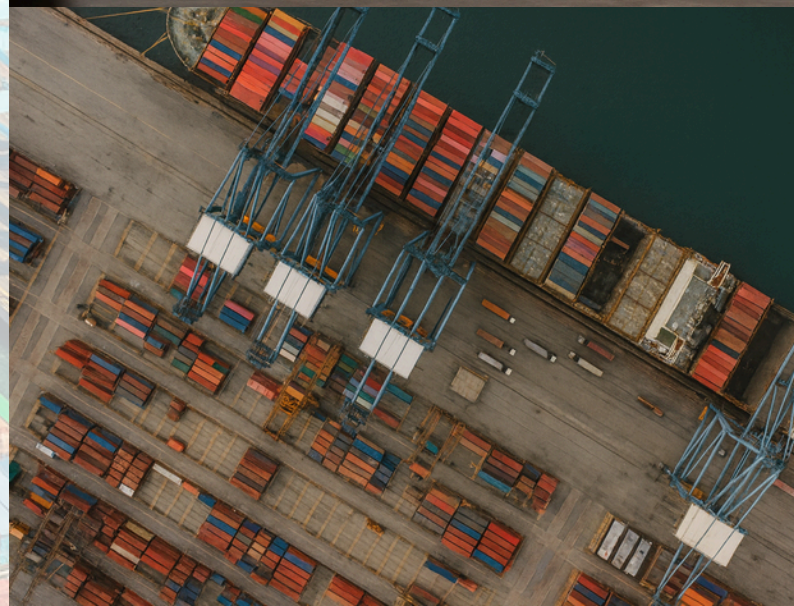
Since in 2024 they represented 24% of global exports of copper concentrate and cathodes, the ports analyzed in this study are Angamos, Coloso, and Ventanas in Chile, and Matarani in Peru.

Puerto Angamos, located in Mejillones Bay, is a multipurpose terminal with strong specialization in minerals. In 2024, it handled 1.2 million tons of contained copper (Puerto Angamos, 2025). It serves mines such as Chuquicamata, Centinela, Spence, and Mantoverde, connected by rail (FCAB) and trucks. In 2024, it inaugurated a 35,000-ton warehouse for concentrates, and in 2025, the new Terminal Graneles del Norte (TGN) berth came into operation (Puerto Angamos, 2025; Complejo Portuario Mejillones, 2025).

Puerto Coloso, also in Antofagasta, is an exclusive port of Escondida (BHP), exporting around 1 million tons of contained copper annually through direct pipelines from the mine site (Cochilco, 2025; BHP, 2019).

Puerto Ventanas, located in the Valparaíso Region, operates as a multipurpose terminal. In 2024, 43% of its transfers corresponded to copper concentrates, with a volume of approximately 1.5 million tons of contained copper (Puerto Ventanas, 2025). It is supplied by mines such as Andina, El Teniente, and Los Bronces, which rely on trains and trucks (PortalPortuario, 2024).

Finally, Puerto Matarani in Peru, located in Mollendo, Arequipa, is a multipurpose port that mainly handles concentrates from Cerro Verde, Las Bambas, and Antapaccay. In 2023, 91% of its exports corresponded to copper, totaling 1.2 million tons of contained copper (OSITRAN, 2024; Prensa Regional, 2024). Its logistics system combines truck and rail transport.



RISK OF OPERATIONAL DOWNTIME AT STRATEGIC PORTS

The risk of an increase in port downtime—defined as the periods during which maritime conditions prevent the berthing or departure of large vessels, leading to the total or partial suspension of operations—can be estimated based on the interaction of three factors: hazard, sensitivity, and exposure (Ministry of the Environment, 2020).

The hazard corresponds to the time during which sea conditions prevent vessel operations and is measured through the downtime period; that is, the probability that wave height exceeds the operational limit of 1.5 meters of significant height. In Chile, this evaluation is carried out by the Ministry of the Environment, which calculates the difference between future projections (2035–2065) under an extreme climate scenario (RCP 8.5, Representative Concentration Pathway, which corresponds to a high greenhouse gas emissions scenario with a sharp temperature increase toward the end of the century) and historical data (Ministry of the Environment, 2020).

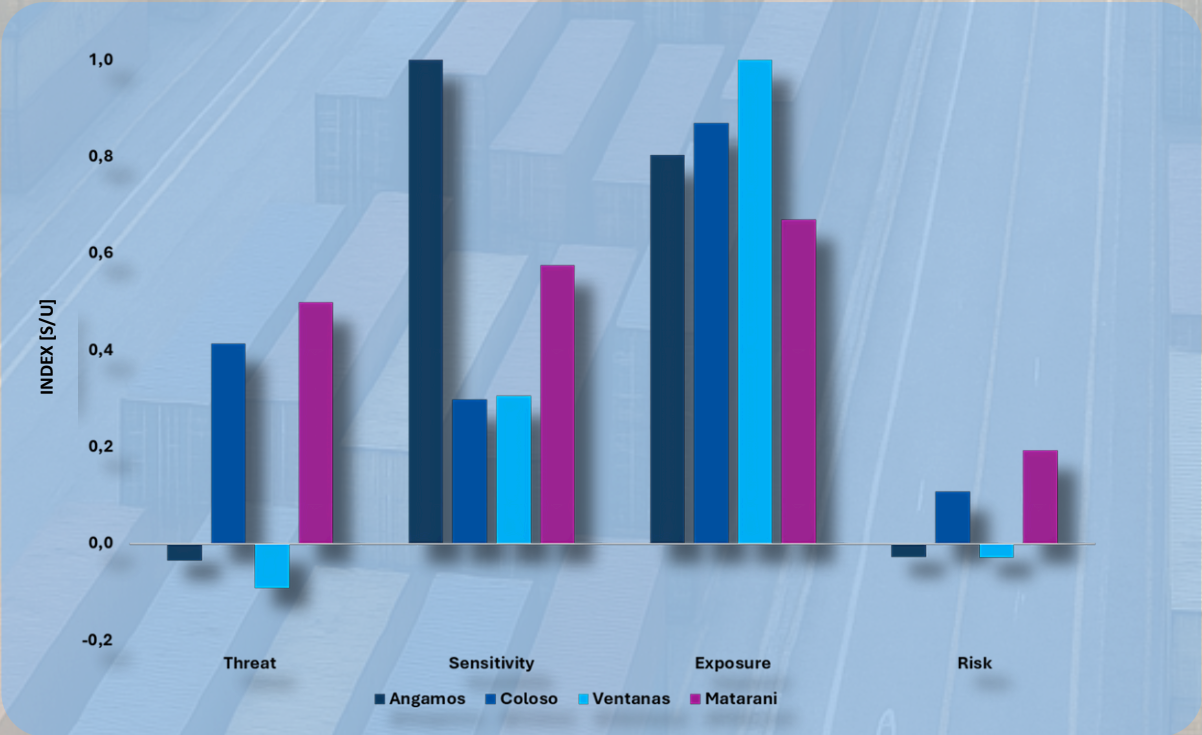
For the case of Peru, the historical port downtime for 2024 is estimated at 14%, based on port closures recorded that year.

Under the RCP 8.5 scenario, projections indicate a reduction, reaching a downtime period of 7% (ESA Climate Office, 2024; Directorate General of Captaincies and Coastguards, 2025; Climate Econometrics, 2025). Sensitivity is assessed based on the historical statistics of port closures for the years 2023 and 2024. To enable comparison between these data, an index is generated: each number of closures is divided by the highest value recorded during the period. Thus, the year with the most closures is represented by the maximum value, equal to 1, while the other years are expressed in proportion to that value.

Finally, exposure corresponds to the volume of copper concentrate handled by each port. To standardize comparisons across ports, the exposure value reported for Puerto Angamos in 2018 is used as a reference (Ministry of the Environment, 2020). This value serves only as a scaling point, allowing the exports of the different ports in 2024 to be expressed in relation to it.

In this way, the risk of increased downtime quantifies the vulnerability of the Angamos, Coloso, Ventanas, and Matarani ports in the face of climate change challenges (Figure 5).

FIGURE 5. HAZARD, SENSITIVITY, EXPOSURE, AND RISK OF INCREASED DOWNTIME AT KEY PORTS



Source: own elaboration

In the case of Angamos, the projected hazard is negative; that is, no significant increase in the frequency or intensity of swells and wave events is expected. However, from a historical perspective, Angamos proved to be the most sensitive port in the study, as it accumulated the highest downtime during 2023 and 2024. Its exposure remains high, as is the case for the other ports analyzed, due to the large volume of cargo handled. Consequently, the risk of increased downtime is considered negative, meaning that its exports would not be compromised in the future, even though recent records show greater operational vulnerability.

In Coloso, the projected hazard corresponds to a moderate increase in swells and wave events. However, its sensitivity is low, as it has recorded relatively limited downtime compared to other ports. Its exposure, on the other hand, is high due to the large tonnage of copper it handles. Thus, the risk of increased downtime at Coloso is considered positive, but of low magnitude.

In the case of Ventanas, the hazard is also negative, with projections indicating a reduction in swells in the future, replicating the situation of Angamos. Its sensitivity is low, while its exposure is the highest among the group, given the large volume of concentrates handled. Therefore, the risk of increased downtime is likewise negative, with no significant effects on the continuity of exports.

Finally, in Matarani, the projected hazard is 0.5 on the index used (on a scale of 0 to 1, where 1 represents the highest frequency of swells), making it the port with the greatest downtime. Its sensitivity is significant, ranking second in terms of days of inactivity during the period analyzed, while its exposure is the lowest, as it handles smaller volumes compared to the Chilean ports. Thus, the risk of increased downtime at Matarani is positive and of significantly high magnitude.



CONSEQUENCES OF PROLONGED DOWNTIME RISK

The analysis of climate risks on port infrastructure acquires fundamental strategic relevance for the mining sector, since the continuity of copper exports depends largely on the operational availability of certain critical ports.

In this context, it is observed that the ports of Angamos and Ventanas do not present risks of increased downtime under climate change scenarios, meaning that 13% of copper concentrate and cathode exports would remain without direct impacts. However, the projected risks at the ports of Coloso (Chile) and Matarani (Peru) represent a significant threat, with the potential to affect 11% of the region's copper export volume.

The motivation for this study lies precisely in quantifying these vulnerabilities: in a scenario where risks materialize due to climate change, the economic and operational impacts could be substantial. Real-world cases—such as three-day closures due to abnormal swells in Peru or even month-long shutdowns caused by flooding in Australia (Glencore, 2019)—demonstrate that logistical disruption is a concrete threat to the industry.

When quantifying the effect of climate change materializing at a port in the form of closures, contingency or mitigation measures that each terminal could implement are excluded. Under the assumption that there is a direct and immediate relationship between mine production and shipment to the port, a three-day closure would mean that copper concentrate could not be dispatched, placing at risk 7,200 tons of contained copper at Coloso, equivalent to USD 68 million, and 16,000 tons of contained copper at Matarani.

At Matarani, this would be equivalent to USD 149 million. Taken together, this would represent 2.2% of the total contained copper exported through these ports in one year (Figure 6). Under a more severe scenario, a 30-day closure would generate much higher losses, such as 72,000 tons of contained copper at Coloso—equivalent to USD 682 million—and 157,000 tons of contained copper at Matarani—equivalent to USD 1.489 billion. This would represent 21.2% of the total volume of contained copper exported through these ports in one year (Figure 6).

It should be noted that the analysis focuses on the largest port operations, although it is also relevant to consider the projects linked to each port. In the case of Coloso, it is an exclusive port whose operation is directly associated with a mine whose lifespan extends beyond 2050, which means that the port will remain exposed to climate change risk for at least another 25 years. Similarly, in Matarani, the most significant mines project a lifespan ranging from 2030 to 2052 (Las Bambas, 2016; Golder Associates, 2018; Freeport-McMoRan, 2025), so this port also remains exposed to risk for at least another 25 years.

Thus, port disruptions not only affect the international supply chain but also have upstream impacts on mining operations. Given the high dependence of strategic mines in both countries on these ports, a prolonged closure would lead to production stagnation and significant delays in export commitments, with financial and reputational effects for the industry as a whole. In addition, it would create challenges in meeting global demand for copper as a critical mineral.

FIGURE 6. IMPACT OF PORT CLOSURES AT COLOSO AND MATARANI DUE TO CLIMATE CHANGE

3 day closure			30 day closure	
Coloso	Matarani		Coloso	Matarani
7.200 [t]	16.000 [t]		72.000 [t]	157.000 [t]
68 [MUS\$]	149 [MUS\$]		682 [MUS\$]	1.489 [MUS\$]
0,6 %	1,6 %		5,5 %	15,7 %

FUTURE-ORIENTED RECOMMENDATIONS

While the risk to ports from climate change has been quantified, it is also important to highlight that risks related to social conflict exist, particularly in Peru. In 2019, the port of Matarani remained closed between July 29 and August 4 due to protests against the Tía María mining project (Semana Económica, 2019). Added to this are road blockades leading to the ports in recent years (Ezerskii, 2024; Red de Medios Regionales Perú, 2025), which in 2023 even resulted in the suspension of operations at the Las Bambas mine for more than two months, with estimated export losses of USD 9.5 million per day (ProActivo, 2023).

Therefore, this growing vulnerability of ports to both climate change and social conflict creates opportunities to strengthen the logistical resilience of copper. Below are action lines that may be considered by public and private stakeholders:

- **Resilient Infrastructure and Climate Adaptation:** Before recommending direct investments, it is advisable to conduct critical infrastructure studies to identify vulnerabilities and model scenarios of operational continuity in the face of climate change. These analyses, which incorporate climate projections and risks such as swells or flooding, can guide decision-making and help reduce the economic losses associated with temporary closures. Based on these diagnostics, subsequent lines of action could include the evaluation of port works with adaptation criteria, such as elevated docks, coastal defenses, or improved drainage systems (European Environment Agency, 2020).
- **Digitalization and Early Warning Systems:** The implementation of artificial intelligence technologies and predictive wave modeling can optimize real-time operational management. These tools would facilitate the dynamic adjustment of vessel schedules, the rescheduling of cargo, or the redirection to alternative terminals, thereby minimizing downtime and ensuring the shipment of minerals under adverse conditions (UN Trade & Development, 2023).
- **Logistics Diversification:** The high dependence on a limited number of ports increases exposure to risk. As a first step, it is recommended to develop and assess operational contingency plans that identify vulnerabilities and define alternative response options. Based on these analyses, different measures could be considered, ranging from insurance coverage and the use of third-party land transport to the eventual planning of redundant infrastructure.

—such as railway corridors to alternative ports or complementary terminals—when justified. In this way, resilience to climatic or social events is strengthened while also supporting the expansion of new mining projects (World Bank Group, 2024).

The implementation of these measures will enable mining logistics to maintain dynamism and responsiveness, both in the face of extreme events and amid sectoral growth. The development of alternative ports, the expansion of transport corridors, or the operational flexibility of each port could prevent bottlenecks in projects such as the Antapaccay-Corocchohuayo expansion (Rumbo Minero, 2025), thereby reducing dependence on the port of Matarani. Likewise, it would ensure that large-scale operations such as Las Bambas, once operating at full capacity (Salazar, 2025), do not face logistical restrictions that could compromise both company and national competitiveness in the global copper market.

In addition, mining countries such as Peru are continuously promoting new projects, among which Tía María—currently in the detailed engineering stage—stands out, along with the probable projects Zafranal and Trapiche, both at the feasibility stage, and the possible projects Los Chancas, Cotabambas, Haquira, Quechua, and Antilla, all at the pre-feasibility stage (Ministry of Energy and Mines, 2025). Since all of these are located in areas adjacent to operations that already rely on Matarani, they would significantly increase the demand on this port, with a consequent potential risk of collapse if its capacity is not expanded or if logistics infrastructure is not diversified.

Ultimately, copper has become a critical mineral for global energy and technological security, and port logistics is the key link connecting its extraction to global demand. The risks stemming from climate change and social conflict represent concrete threats to the continuity of exports, particularly in South America. Nevertheless, by incorporating adaptation criteria, technological innovation, and route diversification, these risks can be transformed into a strategic opportunity. Ensuring the operational continuity of ports means ensuring that Chile and Peru can meet the growing demand associated with the energy transition and artificial intelligence, thereby reinforcing the region's position as a reliable partner in the global copper supply.

BIBLIOGRAPHY

BHP. (2019). Reporte de Avance del Convenio de Cooperación entre Ministerio de Energía y Consejo Minero. Recuperado de <https://consejominero.cl/wp-content/uploads/2019/08/Escondida-2018.pdf>.

Cochilco. (2022). Anuario de Estadísticas del Cobre y Otros Minerales 2004-2023. Recuperado de <https://www.cochilco.cl/web/anuario-de-estadisticas-del-cobre-y-otros-minerales/>.

Cochilco. (2025). Histórico producción de cobre y molibdeno. Recuperado de <https://www.cochilco.cl/web/historico-produccion-de-cobre-y-molibdeno/>.

Complejo Portuario Mejillones. (2025). Inauguran nuevo terminal portuario para embarcar concentrados de cobre con una inversión de US\$ 130 millones. Recuperado de <https://mejillones.com/es/cpm/inauguran-nuevo-terminal-portuario-para-embarcar-concentrados-de-cobre-con-una-inversion-de-us-130-millones/>.

Chile Aduanas. (2024). Anuario estadístico 2024. Recuperado de <https://www.aduana.cl/estadisticasCOMEX/anuario/2024/pdfs/anuario.pdf>.

Climate Econometrics. (2025). Sea-Level Projections [RCP Scenarios]. Recuperado de https://www.climateeconometrics.org/sealevel_rcp/.

Devi, A. (2025). Banjir Rob Ancam Pesisir Surabaya hingga 5 Mei 2025, Ini Imbauan BMKG. En DetikJatim. Recuperado de <https://www.detik.com/jatim/berita/d-7892774/banjir-rob-ancam-pesisir-surabaya-hingga-5-mei-2025-ini-imbauan-bmkg>.

Dirección General de Capitanías y Guardacostas. (2025). Estado de puertos. Recuperado de <https://www.dicapi.mil.pe/estado-de-puertos>.

ESA Climate Office. (2024). Ocean wave patterns present evolving threat. Recuperado de <https://climate.esa.int/en/news-events/ocean-wave-patterns-present-evolving-threat/>.

European Environment Agency. (2020). Climate-resilient infrastructure, policy perspectives. Recuperado de <https://climate-adapt.eea.europa.eu/en/metadata/publications/climate-resilient-infrastructure-policy-perspectives>.

Ezerskii, T. (2024). Tercer día de paro en Moquegua: manifestantes soldaron una tranquera metálica en la entrada del puente Montalvo. Recuperado de <https://www.infobae.com/peru/2024/12/06/tercer-dia-de-paro-en-moquegua-manifestantes-soldaron-una-tranquera-metalica-en-la-entrada-del-puente-montalvo/>.

Ezerskii, T. (2025). Fenómeno en costa peruana hasta el 11 de mayo: Marina de Guerra cierra 80 puertos en todo el litoral. Recuperado de <https://www.infobae.com/peru/2025/05/08/fenomeno-en-costa-peruana-hasta-el-11-de-mayo-marina-de-guerra-cierra-80-puertos-en-todo-el-litoral/>.

Freeport-McMoRan. (2025). Technical Report Summary of Mineral Reserves and Mineral Resources for Cerro Verde Mine. Recuperado de <https://fcx.com/sites/fcx/files/documents/operations/TRS-CerroVerde.pdf>.

Glencore. (2019). 2019 Half-Year Production Report. Recuperado de <https://www.glencore.com/media-and-insights/news/2019-half-year-production-report#:~:text=Own%20sourced%20sales%20during%20H1,North%20Queensland%20that%20damaged>.

Golder Associates. (2018). Resumen ejecutivo MEIA Antapaccay expansión Tintaya – integración Corocchohuayco. Recuperado de https://www.senace.gob.pe/wp-content/uploads/filebase/comunicaciones/eia-meia/antapaccay/Resumen-Ejecutivo_Antapaccay.pdf.

International Copper Study Group. (2024). World Copper Factbook 2024. Recuperado de <https://icsg.org/copper-factbook/>.

International Energy Agency. (2025). Global Critical Minerals Outlook 2025. Recuperado de <https://iea.blob.core.windows.net/assets/ef5e9b70-3374-4caa-ba9d-19c72253bfc4/GlobalCriticalMineralsOutlook2025.pdf>.

Las Bambas. (2016). Resumen Ejecutivo de la Tercera Modificación del Estudio de Impacto Ambiental de la Unidad Minera Las Bambas. Recuperado de <https://www.senace.gob.pe/wp-content/uploads/filebase/comunicaciones/eia-meia/unidad-minera-las-bambas-3era-mod/Resumen-Ejecutivo-de-la-Tercera-MEIA-Las-Bambas.pdf>.

Ministerio de Energía y Minas. (2025). Cartera de proyectos de inversión minera 2025. Recuperado de <https://cdn.www.gob.pe/uploads/document/file/8000189/6722917-cpim-2025.pdf?v=1755709882>.

Ministerio del Medio Ambiente. (2020). Aumento de downtime en puertos estatales. Recuperado de https://arclim.mma.gob.cl/atlas/view/puertos_cbit/#_ftn1.

Naciones Unidas. (2025). Trade Data. Recuperado de <https://comtradeplus.un.org/TradeFlow>.

Organización Mundial del Comercio. (S.f.). Transporte marítimo. Recuperado de https://www.wto.org/spanish/tratop_s/serv_s/transport_s/transport_maritime_s.htm.

OSITRAN. (2024). Informe de desempeño 2023, Concesión del Terminal Portuario de Matarani. Recuperado de <https://www.ositran.gob.pe/anterior/wp-content/uploads/2024/07/id-tisur-2023.pdf>.

Port of Townsville. (2020). Environmental and Social Values Surrounding the Port of Townsville. Recuperado de https://s3-ap-southeast-2.amazonaws.com/os-data-2/townsville-port-2/bundle2/pot_1898_r1_environmental_and_social_values_surrounding_the_port_of_townsville.pdf.

BIBLIOGRAPHY

Port of Townsville. (2021). Cyclones. Recuperado de <https://www.townsville-port.com.au/operations/safety-security/emergency-procedures/cyclones/>.

PortalPortuario. (2024). EFE abre licitación para obras del ramal San Pedro-Ventanas con enfoque en transporte de carga. Recuperado de <https://portalportuario.cl/efe-abre-licitacion-para-obras-del-ramal-san-pedro-ventanas-con-enfoque-en-transporte-de-carga/#:~:text=%E2%80%9CEstas%20mineras%20recorren%20grandes%20tramos,log%C3%ADstico%20y%20de%20confiabilidad%E2%80%9D%2C%20a%C3%B1adi%C3%B3>.

PortalPortuario. (2025). Marejadas obligan a un segundo portacontenedores a omitir recalada a Puerto Angamos. Recuperado de <https://portalportuario.cl/marejadas-obligan-a-un-segundo-portacontenedores-a-omitir-recalada-a-puerto-angamos/>.

Prensa Regional. (2024). Puerto de Matarni: Líder en carga de minerales en Latinoamérica. Recuperado de <https://prensaregional.pe/puerto-de-matarani-lider-en-carga-de-minerales-en-latinoamerica/#:~:text=Adem%C3%A1s%2C%20Paz%20enfatz%C3%B3%20la%20importancia,a%20seguir%20para%20el%20futuro>.

ProActivo. (2023). Minera Las Bambas reinicia sus operaciones. Recuperado de <https://proactivo.com.pe/minera-las-bambas-reinicia-sus-operaciones/#:~:text=cobre%20Las%20Bambas%2C%20una%20de,para%20continuar%20con%20las%20exportaciones>.

PT Freeport Indonesia. (2022). Take Note! Total copper export reaches 2 million tons in 2021. Recuperado de <https://ptfi.co.id/en/news/detail/take-note-total-copper-export-reaches-2-million-tons-in-2021#:~:text=The%20Ministry%20of%20Energy%20and,predicted%20to%20last%20until%202044>.

Puerto Angamos. (2025). Memoria Anual 2024. Recuperado de <https://www.puertoangamos.cl/wp-content/uploads/2025/04/Memoria-Puerto-Angamos-TGN-2025.pdf>.

Puerto Ventanas. (2025). Memoria Integrada 2024. Recuperado de <https://puertoventanas.cl/content/uploads/2025/04/PVSA-Reporte-Integrado-2024-250403-1.pdf>.

Red de Medios Regionales Perú. (2025). Moquegua: Paro regional bloquea principales vías en protesta contra el Proyecto Minero Huatipuka. Recuperado de <https://inforegion.pe/moquegua-paro-regional-bloquea-principales-vias-en-protesta-contra-el-proyecto-minero-huatipuka/>.

Reuters. (2021). Compradores de cobre buscan concentrado en otras partes de cara a reducción de envíos en Indonesia: CRU. En Euro News. Recuperado de <https://es.euronews.com/next/2021/06/08/mineria-indonesia-cobre>.

Reuters. (2025). US Interior Department proposes adding copper to critical minerals list. Recuperado de <https://www.reuters.com/business/us-interior-department-proposes-adding-copper-critical-minerals-list-2025-08-25>.

Rumbo Minero. (2025). Proyecto Expansión Antapaccay-Corocchohuayco: Así avanza la consulta previa con las comunidades. Recuperado de <https://www.rumbominero.com/peru/noticias/mineria/proyecto-expansion-antapaccay-corocchohuayco/>.

Salazar, E. H. (2025). Las Bambas espera romper la barrera de 400.000 t de cobre en 2025, consolidándose como una de las minas más grandes del mundo. Recuperado de <https://www.infobae.com/peru/2025/03/13/las-bambas-espera-romper-la-barrera-de-400000-t-de-cobre-en-2025-consolidandose-como-una-de-las-minas-mas-grandes-del-mundo/>.

Semana Económica. (2019). Matarani: cierre costoso. Recuperado de <https://semanaeconomica.com/sectores-empresas/industria/369938-matarani-cierre-costoso>.

UN Trade & Development. (2023). Review of maritime transport 2023. Recuperado de <https://unctad.org/publication/review-maritime-transport-2023>.

Puerto Angamos. (2025). Memoria Anual 2024. Uniradio Informa. (2024). Cierran puertos para embarcaciones menores y mayores en Sonora. Recuperado de <https://www.uniradioinforma.com/sociedad/cierran-puertos-embarcaciones-menores-mayores-sonora-n771415>.

U.S. Department of the Interior. (2025). Department of the Interior releases draft 2025 List of Critical Minerals. Recuperado de <https://www.doi.gov/pressreleases/departament-interior-releases-draft-2025-list-critical-minerals>.

Verschuur, J., Koks, E. E., & Hall, J. W. (2023a). Systemic risks from climate-related disruptions at ports. Nature Climate Change, 13, 804-806. <https://doi.org/10.1038/s41558-023-01754-w>.

World Bank Group. (2024). Resilient and Inclusive Supply-Chain Enhancement (RISE). Recuperado de <https://www.worldbank.org/en/programs/egps/brief/resilient-and-inclusive-supply-chain-enhancement>.

AUTHORS



PAULINA CÁ CERES
Project Engineer
pcaceres@gem-mc.com



ISAAC PAREDES
Practice Leader, Evaluation
iparedes@gem-mc.com

EDITION

MERY-ANN GIESE
Head of Administration and Marketing
magiese@gem-mc.com

JAVIERA ALEMPARTE
Press and Communications Coordinator
jalemparte@gem-mc.com

COMMERCIAL CONTACT BY PRACTICE AREA



Isaac Paredes
Practice Leader Evaluation
iparedes@gem-mc.com



Manuel Cordero
Practice Leader Planning
mcordero@gem-mc.com



Sebastián Faúndez
Practice Leader Analytics
sfaundez@gem-mc.com

COMMERCIAL CONTACT FOR AUSTRALIA AND ASIA-PACIFIC



Cristóbal Olave
Business Development Manager
colave@gem-mc.com

GENERAL COMMERCIAL INQUIRIES



Felipe Guzmán
Partner - Chief Financial,
Administration and Marketing
Officer

OFFICES



Chile: Las Condes 12.461,
tower 3, offices 805-806,
Las Condes, Santiago



Singapore: 9 Straits View, Marina
One West Tower, #05-07,
Singapore

