SUMMARY OF THE PRE-FEASIBILITY STUDY TECHNICAL REPORT ON THE IOM POLYMETALLIC NODULES PROJECT IN CLARION-CLIPPERTON ZONE – EXPLOITABLE BLOCK H22_NE (2024)

The report was prepared by a team of experts in economic geology, marine geology, mining technology, ship construction, processing technology and environmental research from Interoceanmetal Joint Organization (P. Baláž - editor, T. Abramowski, I. Dreiseitl, G. Guerrero, A. Krawcewicz, K. Mianowicz, B. Shiryaev, V. Stoyanova) and Qvistorp S.A. (M. Urbanek). Resources estimation update was prepared by experts from AGH University of Science and Technology (J. Mucha and M. Wasilewska-Błaszczyk).

Location

The Clarion-Clipperton Zone (CCZ), located in the eastern tropical Pacific (Figure 1.1), is considered a reserve base of the world's most economically beneficial deposit of polymetallic nodules (PMN). Their economic values are derivative of their chemical composition: polymetallic nodules contain nickel, manganese, cobalt, copper, zinc and other economically valuable components. Market of these metals and nickel, cobalt and copper in particular, is expected to be continuously growing due to increasing demand for batteries for electric mobility (environmentally motivated transition to green society).

Interoceanmetal Joint Organization (IOM) has been operating in the CCZ for more than 35 years now, conducting the exploration work within its license area covering 75,000 km^2 and granted in a form of contract by the International Seabed Authority (ISA). One of the key responsibilities of the ISA, within legal frames defined by the 1992 United Nations Convention on the Law of the Sea (UNCLOS) and the 1994 Implementation Agreement, is governance of the development of seabed resources in the Area (beyond the limits of national jurisdiction).

IOM is the intergovernmental institution sponsored by six countries: Bulgaria, Cuba, Czechia, Poland, Russia and Slovakia. Exploration work of IOM focuses on geologic, environmental, economic and technologic aspects of the future possible exploitation of polymetallic nodules. The IOM claim area consists of two sectors: B1 and B2 with four exploration blocks H11, H22, H33 and H44 located in sector B2, delineated as the most prospective (in terms of nodules abundances) areas.

IOM has been considering various scenarios for the implementation of the polymetallic nodule mining project, taking into account data collected. Results of the works were used to define the optimal business model of the project, determine its scale and technical scope. An in-depth analysis of alternative project's options led to the development of the project assumptions, which are the basis for the present Pre-Feasibility Study.

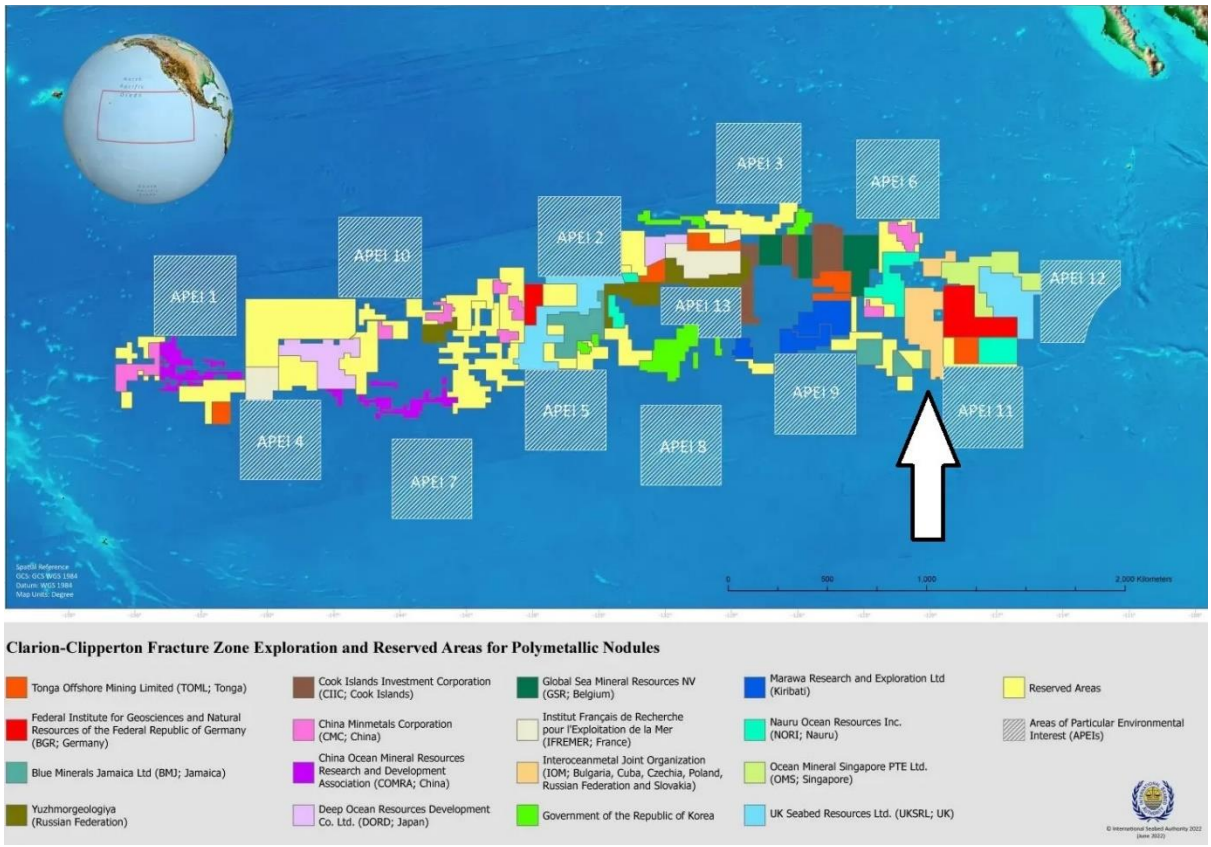

Figure 1.1 The IOM license area (light orange colored areas) in the CCZ, Eastern Pacific (ISA, 2023)

Resources

The total resources of the IOM exploration area are estimated at 272.5 Mt of wet nodules (abundance cut-off is 10 kg/m^2 of wet nodules; volcanoes, areas free of nodules and areas sloped over 7° were excluded from the estimation). Of this amount, 12.2 Mt are Measured resources, 77 Mt are Indicated resources and 183.3 Mt are Inferred resources.

Resources estimate in the H22_NE exploitable block is based on data collected during scientific expeditions carried out by IOM. So far, two reports using geostatistical data analysis have been prepared evaluating data from H22_NE (Mucha & Wasilewska-Błaszczyk, 2020, Mucha & Wasilewska-Błaszczyk, 2024). Validations was performed by the Competent Person for estimation carried out in 2020 (Szamałek, 2020). The current state is shown in Table 1.1. The effective date for the estimate is August 2020. No mineral reserves were estimated at this stage of the project development.

An alternative estimate of resources in the H22_NE exploitable block was prepared (Table 1.2) using processed seabed photographs to calculate nodule abundance (Mucha & Wasilewska-Błaszczyk, 2024).

Table 1.1 Mineral resource estimate of wet polymetallic nodules in the H22_NE exploitable block (2020). Cut-off 10 kg/m^2 of wet nodules - without volcanoes, seabed areas free of nodules and areas sloped over 7°

Mineral resource classification (2020)	Mean Abundance (kg/m^2)	Mn (%)	Ni (%)	Cu (%)	Co (%)	Zn (%)	REE (ppm)	Resources Wet (Mt)
Measured	14.6	29.19	1.31	1.25	0.18	0.15	713	12.2
Indicated	na	na	na	na	na	na	na	0
Inferred	na	na	na	na	na	na	na	0
Total								12.2

Table 1.2 Alternative mineral resource estimate of wet polymetallic nodules in the H22_NE exploitable block (2024). Cut-off 10 kg/m^2 of wet nodules - without volcanoes, seabed areas free of nodules and areas sloped over 7°

	Mean Abundance (kg/m^2)	Mn (%)	Ni (%)	Cu (%)	Co (%)	Zn (%)	REE (ppm)	Resources Wet (Mt)
Mineral resource estimate (2024)	12.6	30.58	1.33	1.27	0.18	0.15	697	8.3

Economic assessment

The project's purview is sharply focused on the extraction and sale of polymetallic nodules. This narrowed focus is a direct outcome of the significant capital demands and the logistical and economic challenges associated with achieving a viable market scale for a processing plant, which would necessitate an annual processing throughput of at least 5 million tons of raw material. Given these constraints, IOM recognizes its present limitations in erecting the infrastructure necessary to ensure the cost-competitive production of metals. Moreover, it was determined that regardless of the technological route chosen, none would yield return on investment rates that could be deemed satisfactory.

IOM explored a diverse range of strategic options, each with its unique implications for the polymetallic nodule mining project. These considerations were systematically assessed to identify the most promising scenario for the project's advancement. The strategic options analysed included:

- Sale of mining concessions: transferring mining rights to another entity in exchange for immediate financial gain or a stake in future profits;
- Leasing of exploitation rights: granting another party the right to exploit the nodules while retaining ownership and a degree of control over the mining operations;
- Outsourcing model for nodule extraction: partnering with external companies to handle the extraction process, minimizing capital investment and operational risks;
- Autonomous conduct of all mining operations: IOM taking full control over the mining operations, from extraction to sale, requiring substantial investment in infrastructure and technology.

Key factors considered in the evaluation process included:

- Production scale: determining the optimal size of operations to balance investment costs with expected revenues;
- Location of processing facilities: selecting the optimal location for processing facilities based on logistical, economic, and environmental considerations. The focus was on ensuring efficient delivery of raw polymetallic nodules;
- Scope of investment: assessing whether to limit the project scope to merely extraction and sale or to expand it to include significant investments in constructing a metallurgical plant.

After analysis, the scenario deemed most promising involves:

- Focusing on the extraction of 1.5 million tons of wet nodules: prioritizing a manageable yet profitable scale of operation;
- Subsequent sale to a facility in Cuba (Moa Bay): leveraging strategic partnerships to ensure a reliable and profitable outlet for the extracted nodules.

This scenario was adjudged to optimally balance an acceptable level of business risk with IOM's financial capabilities and the anticipated business returns.

The aim of this study is, among other objectives, to optimize the selected investment scenario and analyze the stability of the assumed economic outcomes under changing business environment conditions (macroeconomic, legal, environmental, and climate changes). It also examines alternative options for acquiring a Production Support Vessel (PSV) by comparing the economic effects of scenarios that include its construction (Scenario 2 - incorporating the ship's construction costs directly into the capital expenditures) with a scenario assuming the leasing of the vessel (Scenario 1 - bareboat charter), i.e., accounting for the costs of using the unit in the project's operational expenses. Consequently, these two alternative investment scenarios differ in terms of operational costs and capital investments (Table 1.3).

The comparative analysis of these scenarios aimed to identify which approach would offer the best balance between cost efficiency and operational effectiveness, taking into account the project's financial structure and strategic objectives. The study meticulously calculated the differential impacts on operational costs and investment requirements, providing a clear financial perspective on the most viable option for PSV acquisition within the context of the broader investment strategy.

Table 1.3 Comparison of differences in assumptions between scenarios

Item	Unit	Scenario 1	Scenario 2	Sc.1 vs Sc.2
Initial CAPEX (without recurring CAPEX)	USD million	323.2	626.5	-48%
Total CAPEX (including recurring CAPEX)	USD million	849.6	1,274.21	-33%
Mining annual OPEX	USD million	122.6	91.0	+35%
Total annual OPEX	USD million	178.9	121.0	+21%

In addition to the direct economic benefits derivable from the nodule sales, significant project realization advantages were identified in securing access to strategic metal reserves and in the development of unique competencies. These include the mastery of cutting-edge mining technologies, the advancement of environmentally sustainable extraction methodologies, and the

establishment of strategic partnerships within the global metallurgical industry, thereby solidifying IOM's stature in the international mining arena.

Given that the project's implementation delivers both financial rewards and strategic benefits, the evaluation of the project's economic efficiency (through hard KPIs) was not the sole determinant in the selection of the most attractive investment scenario. Considerations also extended to the strategic impact of the investment and the encompassing risk profile. This comprehensive evaluation approach highlights the importance of achieving a balance between immediate economic returns and the pursuit of long-term strategic objectives, ensuring that the project not only bolsters IOM's financial standing but also enhances its strategic positioning and resilience in the face of global mining industry challenges.

The economic assessment of the IOM project reveals promising outcomes in both proposed scenarios (Table 1.4). Specifically, Scenario 1 exhibits an Internal Rate of Return of 24.2%, surpassing the hurdle rate of 12.9%, with a negligible probability (0.6%) of the Net Present Value falling below zero. Scenario 2 presents an IRR of 17.35% against the same hurdle rate, although it carries a significantly higher risk, with an 80.3% chance of NPV being less than zero.

Table 1.4 Comparison of economic outcomes of two investment scenarios

Item	Unit	Scenario 1	Scenario 2	Sc.1 vs Sc.2
Net Present Value (NPV)	USD million	160.81	88.81	+81%
Internal Rate of Return (IRR)	%	24.21	17.35	+40%
Modified Internal Rate of Return (MIRR)	%	12. 55	10.96	+15%
Equivalent Annual Annuity (EAA)	USD million	21.18	11.7	+81%
Profitability Index (PI)	ratio	1.89	1.28	+48%
Discounted Payback Period (dPP)	years	16.11	21.61	-25%
Total EBITDA	USD million	4,768.39	5,432.22	-12%
Average Yearly EBITDA	USD million	149.01	169.75	-12%
Total Project EBIT	USD million	4,004.16	4,243.39	-6%
Average yearly Project EBIT	USD million	125.13	132,61	-6%
Total CAPEX	USD million	849.6	1,274.21	-33%

These findings strongly support the economic feasibility of continuing the project. However, it's critical to acknowledge that these results derive from limited data sources, such as the polymetallic nodules price estimation, and are based on conservative projections, including a 40% contingency for Capital Expenditure (CAPEX).

High level of uncertainty, however, is associated with a wide range of risks that IOM must deal with. As the knowledge surrounding the extraction and processing of metals from PMN advances in the coming years, it is anticipated that many current uncertainties will be resolved. Nonetheless, the project faces a broad spectrum of risks, including, but not limited to, changes in environmental laws, the legal status of IOM, potential licensing issues with the International Seabed Authority (ISA), political factors, technological challenges, market dynamics, and the possibility of higher investment costs than initially estimated. The primary technological hurdles, especially in the realms of extraction and metal refining, currently impede the commercial viability of such ventures. Yet, it is forecasted that these obstacles will be surmounted within the next 5 to 10 years, paving the way for commercial operations.

Despite being a high-risk venture, the IOM project holds substantial promise due to the escalating demand for battery metals, which are abundant in PMN. This increasing demand is expected to drive up the prices of essential metals for battery production, enhancing the project's profitability. However, this potential could be moderated by the gradual increase in supply from traditional land-based mining, recycling efforts, and other offshore deposits.

The IOM project is not only a business endeavor but also carries significant social, economic, and environmental implications, potentially playing a pivotal role in the global shift towards clean energy and electric mobility. To mitigate risks and enhance the project's viability, IOM is considering several strategic initiatives:

- Enhancing technical knowledge: improving understanding and efficiency in mining and metal extraction processes to ensure the profitable sale of raw ore;
- Resource development: securing and enhancing the resources necessary for operational success;
- Cost Reduction Strategies: identifying and implementing measures to lower operational and capital expenses;
- Corporate restructuring: transitioning IOM into a commercial law entity with transparent share distribution, and defined contributions to project profits and expenses;
- Strategic partnerships: seeking partnerships in technology and sales to bolster project capabilities and market reach.

These strategies are aimed at reducing project risks and ensuring the long-term sustainability and success of the IOM initiative, emphasizing its potential to contribute to the global transition to sustainable energy sources.