



The Future of Nickel Mining Industry – Study at PT VALE

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ABSTRACT: Indonesia is the world's largest producer of nickel. With the increasing global demand for nickel, it presents an opportunity for Indonesia to enhance its revenue potential through the export of nickel ore. Concurrently, the Government of the Republic of Indonesia has implemented policies to promote the downstream processing of nickel ore, thereby creating a multiplier effect on the country's economy. PT VALE Indonesia stands as one of the largest nickel mining companies in Indonesia. The opportunity to process nickel ore holds the potential for added value and profits for PT VALE Indonesia. However, the production and sales of nickel by the company have experienced a decline over the years. This becomes intriguing as valuing the company requires forecasting nickel prices.

This research analyzes the historical performance of PT VALE Indonesia and provides insights into potential further declines in performance, offering strategic steps as preventive measures for the company's sustainability. Utilizing nickel price projections and pro forma methods, this research represents a form of company valuation study. Additionally, it sheds light for investors that, as of December 30, 2022, the company was undervalued by the market.

KEYWORDS: Nickel Mining, PT VALE, performance.

I. INTRODUCTION

The shift from gasoline-powered vehicles to electric vehicles marks a significant transformation in the automotive landscape. A convergence of factors propels this change, each contributing to the evolution and embrace of electric vehicles. At the forefront of this transition is a growing awareness of environmental impact. Traditional gasoline vehicles have long been contributors to global emissions, prompting concerns about air quality and climate change. In contrast, electric vehicles present a promising solution, producing zero tailpipe emissions and offering a path towards a cleaner, more sustainable mode of transportation.

Technological advancements, particularly in battery technology, have been instrumental in making electric vehicles more feasible and appealing. The steady decline in the cost of lithium-ion batteries over the past decade has significantly lowered barriers to entry, making electric vehicles more affordable for consumers worldwide. Governments across the globe have also played a pivotal role in fostering the shift to electric vehicles. Through various policies, incentives, and regulations, they aim to incentivize the adoption of cleaner transportation alternatives. Measures such as subsidies, tax credits, and infrastructure development initiatives have been implemented to encourage both consumers and manufacturers to embrace electric vehicles.

In response to this changing landscape, the automotive industry is undergoing a fundamental transformation. Major manufacturers are investing heavily in research and development to improve electric vehicle technology, aiming for enhanced performance, increased range, and more efficient charging capabilities. Bold commitments to phase out internal combustion engines in favor of electric and hybrid models signal a seismic shift within the industry.

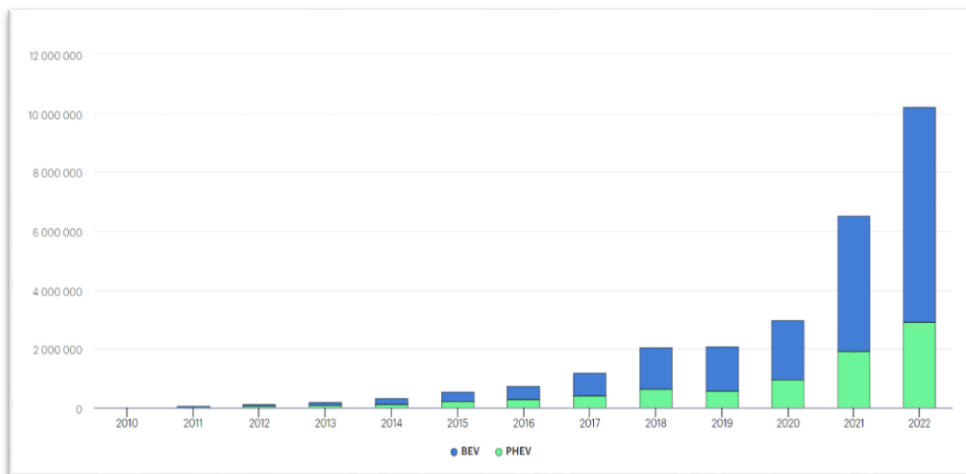


Figure 1. 1 EV sales, cars, World, 2010-2022
 Source: International Energy Agency (IEA.org)

Over the past decade, a noticeable surge in electric vehicle (EV) sales has marked a significant shift in the automotive industry. This shift is particularly evident in the preference for Battery Electric Vehicles (BEVs) over Plug-in Hybrid Electric Vehicles (PHEVs) on a global scale. The trend showcases a growing inclination toward pure electric vehicles, possibly owing to advancements in battery technology, increased driving range, and a stronger emphasis on zero-emission transportation solutions. Notably, the data from the last five years, spanning from 2017 to 2022, paints a compelling picture of this rapid transition. During this period, there has been a staggering 764% increase in the sales of all EVs, indicating a substantial and rapid acceptance of electric vehicles among consumers worldwide. This surge is reflective of evolving consumer attitudes, policy interventions promoting cleaner transportation, and the automotive industry's concerted efforts to meet the burgeoning demand for more environmentally friendly mobility options. These statistics underscore a paradigmatic shift in the market dynamics, suggesting a pivotal moment in the trajectory toward a more sustainable transportation ecosystem.

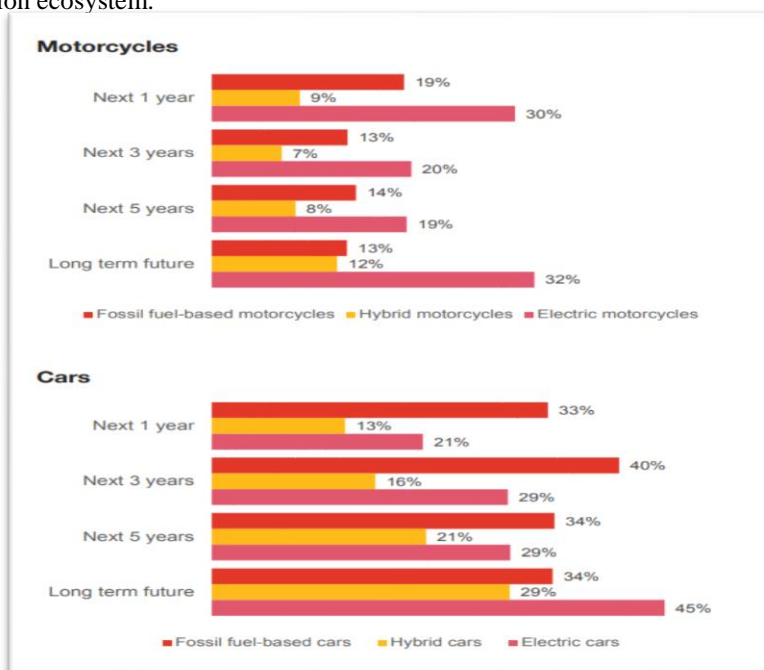


Figure 1. 2 Motor vehicle purchasing sentiment in one, three, five years, and the long term.
 Source: PricewaterhouseCoopers (PwC) Indonesia



Specifically, in Indonesia, the interest and preference data indicates a gradual but distinct inclination towards electric motorcycles compared to fossil fuel-powered ones within the upcoming year, with approximately 30% of respondents favoring electric models versus 19% for fossil fuel-based ones. However, the shift toward hybrid or electric cars appears to have a slower initial adoption rate, with 33% inclined towards fossil fuel-based cars in contrast to 13% for hybrids and 21% for electric cars within the year (PwC Indonesia).

Over the long term, a notable transition becomes evident. Around 45% of respondents express an interest in purchasing electric cars, signifying a growing openness to electric mobility solutions. This data suggests a faster uptake for electric motorcycles in the short term. In contrast, the interest in electric cars indicates a progressive shift over the next five years, showcasing evolving consumer preferences toward sustainable transportation options.

I.1 Background

Nickel plays a crucial role in the electric vehicle (EV) industry as a key component in lithium-ion batteries, powering these vehicles. It's primarily used in the cathodes of these batteries, such as nickel-manganese-cobalt (NMC) or nickel-cobalt-aluminum (NCA) compositions, enhancing energy density and performance. The demand for nickel is directly linked to the growing EV market, driving concerns about sustainable sourcing and supply chain challenges. Ensuring a responsible and steady nickel supply becomes vital for sustaining the EV industry's rapid expansion.

The growth of the electric vehicle market heavily relies on the availability and cost-effectiveness of battery materials like nickel. As the demand for electric vehicles escalates, there emerges a concurrent demand for nickel to meet the production needs of high-energy-density lithium-ion batteries. However, this surge in demand for nickel raises concerns regarding its sustainable sourcing, environmental impact, and potential supply chain challenges.

Ensuring a consistent and environmentally responsible nickel supply chain becomes imperative for sustaining the exponential growth of the electric vehicle industry. Innovations in nickel extraction methods, recycling initiatives, and ethical sourcing practices are areas of focus to address these concerns while supporting the expanding demand for nickel-driven by the accelerating adoption of electric vehicles worldwide.

I.2 Company Profile

Established in 1968, PT Vale Indonesia Tbk is a prominent mining company operating in Indonesia, primarily focused on nickel mining and refining. PT Vale Indonesia mines nickel laterite to produce the final product in the form of nickel matte. With a decade-long career blending business acumen and research expertise, PT Vale Indonesia has emerged as a key player in the Indonesian mining sector. PT Vale Indonesia went public on May 16th 1990, listing on the Indonesia Stock Exchange (IDX) under the ticker symbol INCO.

PT Vale operates in Sulawesi, particularly in the Sorowako district. Its primary activities revolve around nickel mining and processing. The company is involved in extracting nickel ore and refining it into nickel matte, a crucial material used in stainless steel production and increasingly important in lithium-ion batteries for electric vehicles.

In 2022, PT Vale showcased robust performance amidst a dynamic market. The company's revenue and production output are essential metrics to analyze its financial health and operational success. PT Vale's core business lies in nickel mining, focusing on sustainable and responsible extraction methods. The company has continuously invested in technology and practices to enhance efficiency, reduce environmental impact, and ensure community engagement and social responsibility.

The average nickel production volume per year reaches 75,000 metric tons. In 2022, the total volume of nickel ore production is set at 11.55 million tonnes, marking a notable decrease of approximately 10.28% compared to the previous year's output of 12.88 million tons. This decline in production volume raises several considerations regarding the factors influencing the mining



landscape. Despite the reduction in annual production, the company's mineral reserves remain a critical asset. As of the reporting period's conclusion, the total volume of the company's mineral reserves stands at 111.55 million tons. While this reflects a slight decrease of about 0.18% from the previous year's reserves of 112.55 million tons, it underscores the enduring significance and substantial mineral wealth that the company holds.

In producing nickel in the Sorowako Block, they use pyrometallurgical technology (melting laterite nickel ore). The nickel we produce is entirely exported to Sumitomo Metal Mining Co, Ltd (Japan) under a special long-term contract between the two companies. Operating under the Contract of Work, which was amended on October 17th 2014 and is valid until December 28th 2025 with a concession area of 118,017 hectares covering South Sulawesi (70,566 hectares), Central Sulawesi (22,699 hectares) and Southeast Sulawesi (24,752 hectares).

I.3 Business Analysis

In this particular sub-chapter, the researchers will delve into an in-depth Business Analysis of PT VALE Indonesia. This comprehensive evaluation will be executed through the employment of two fundamental methodologies, namely the PESTLE Analysis for conducting an extensive external analysis and the SWOT method for a thorough exploration of internal factors. This methodological fusion enables a nuanced understanding of the company's competitive positioning, enabling stakeholders to make informed decisions and formulate effective strategies aligned with the prevailing industry dynamics and the company's intrinsic capabilities.

I.3.1 PESTLE Analysis

The PESTLE Analysis, an acronym encompassing Political, Economic, Social, Technological, Legal, and Environmental factors, serves as a robust framework to scrutinize and comprehend the external landscape within which PT VALE Indonesia operates. This method facilitates the identification and assessment of various macro-environmental facets impacting the company's operations, providing valuable insights into potential opportunities and threats stemming from the broader industry, regulatory changes, socio-cultural trends, technological advancements, legal frameworks, and environmental considerations.

1. Political Factors:

- Government Regulations: The mining industry in Indonesia operates within a regulatory framework governed by a spectrum of governmental policies and regulations, encompassing licensing protocols, stringent environmental compliance standards, and taxation mandates. The most recent example pertains to the downstream regulation of nickel processing in Indonesia, premised on the anticipation of amplifying value addition capabilities. This is envisioned to serve as a catalyst, potentially augmenting the national economy by bolstering the Gross Domestic Product (GDP) index and fostering an upsurge in investment. This exemplifies a strategic initiative aimed at optimizing the economic potential inherent in the nickel processing sector, foreseeably leading to enhanced economic growth, increased industrial value, and heightened investor confidence in Indonesia's economic landscape. These multifaceted regulations not only serve as benchmarks for operational conduct but also exert considerable influence on the strategic direction, expansion initiatives, and day-to-day operations of mining companies within the country, posing both challenges and opportunities for their sustainable growth and development.

- Political Stability: The consistent stability and reliability exhibited within the governmental structures and political landscape wield a profound influence, serving as foundational pillars that profoundly shape and mold the expansive business environment. Within the multifaceted domain of the mining sector, these aspects carry immense significance, significantly dictating the levels of investment allure and viability. The upcoming presidential election in 2024 introduces an element of uncertainty into the anticipation of political stability. The potential change in leadership or presidency brings forth the likelihood of regulatory modifications, particularly



within the nickel mining sector. Such alterations in governance, driven by shifts in leadership, possess the capacity to significantly impact policies, market dynamics, and investment landscapes. Consequently, this dynamic interplay between political transitions and regulatory frameworks may lead to increased unpredictability, thereby influencing strategic decision-making processes and investment patterns within the nickel mining industry. A consistent and predictable political framework not only fosters an environment conducive to sustained economic growth but also bolsters investor confidence, thereby attracting substantial investments essential for the development and expansion of the mining industry.

2. Economic Factors:

- **Commodity Prices:** The economic dynamics and performance of nickel mining enterprises in Indonesia are intricately linked and profoundly influenced by the prevailing global nickel prices, which wield a substantial impact on the companies' revenue streams and overall profitability within the nickel mining sector. In Indonesia, the pricing of nickel is governed by legislative regulations established by the government, thereby setting standardized benchmarks for its valuation. This regulatory framework significantly influences the sales value within the nickel mining industry, exerting a pronounced impact on the overall pricing dynamics of the nickel commodity. The statutory imposition of pricing mechanisms underscores the intricate interplay between governmental policies and the economic landscape, elucidating the consequential ramifications on the valuation and trade of this pivotal mineral resource.
- **Foreign Investment:** Economic conditions and the subsequent policies implemented pertaining to foreign investment exert a direct influence on the overall influx of capital, technological advancements, and expertise within the industry. The nuanced interplay between these economic factors and the regulatory frameworks governing foreign investment significantly shapes the industry's capacity to attract and retain foreign capital, subsequently impacting the infusion of cutting-edge technology and innovative practices into the mining sector.

3. Social Factors:

- **Local Community Relations:** Community engagement and social responsibility initiatives play a pivotal and indispensable role, primarily owing to the inherent recognition of the considerable and far-reaching effects that mining activities can exert on the neighboring local communities. By employing local staff and employees residing in the vicinity of its nickel mining operations, PT VALE aims to contribute significantly to the enhancement of the living standards and socio-economic conditions of the communities within the immediate vicinity of the mining area. This strategy not only serves as a means of promoting economic growth and development but also fosters a sense of community engagement and empowerment by creating job opportunities and supporting the local workforce. Additionally, this approach facilitates the establishment of sustainable relationships between the company and the local community, fostering mutual trust and collaboration for long-term socio-economic progress and welfare.
- **Labor Force:** The availability of a skilled labor force and the complexities associated with workforce-related challenges wield a substantial impact on the overall production output and operational efficiency within an organization. PT Vale consistently invests in enhancing the skill sets of its employees through a structured and comprehensive training regimen. This commitment extends across specialized mining-related expertise as well as broader, universally applicable skills. The company actively fosters a culture of continuous learning and development, ensuring that its workforce remains equipped with the latest industry-specific knowledge while also nurturing their proficiency in general competencies essential for professional growth.

4. Technological Factors:

- **Technological Advancements:** The integration and implementation of cutting-edge mining technologies alongside the adoption of sustainable practices significantly influence not only the operational efficiency but also



the overall environmental impact of mining operations carried out by the company. The integration of technological advancements within the nickel mining sector is intricately linked to the substantial investments injected into this domain, as well as the proficient workforce adept at operating the various asset-oriented resources. This symbiotic relationship between technological adoption and its implementation is pivotal in fostering operational efficiency, enhancing productivity, and optimizing resource utilization within the nickel mining industry. The strategic deployment of investments in innovative technologies, coupled with the cultivation of a highly skilled labor force capable of harnessing these assets, serves as a cornerstone for achieving sustainable growth and competitiveness in this sector.

5. Legal Factors:

- Environmental Regulations: Ensuring strict adherence and full compliance with an array of environmental laws, regulations, and protocols, encompassing comprehensive measures such as rigorous reclamation practices and thorough environmental impact assessments, stands as an essential imperative within the sphere of mining operations. The company has made concerted efforts and implemented comprehensive strategies aimed at assuming full responsibility for sustainability initiatives within the vicinity of the nickel mining operations. These efforts encompass a multifaceted approach involving rigorous environmental impact assessments, proactive community engagement programs, and the integration of advanced technologies to minimize ecological footprints while fostering socio-economic development in the region.
- Mining Licensing: Securing and consistently upholding mining licenses and permits within the intricate and stringent regulatory framework of Indonesia significantly impacts the seamless continuity and sustainability of operational endeavors for mining entities.

6. Environmental Factors:

- Sustainability Practices: Environmental concerns encompassing deforestation, responsible water usage practices, and the preservation of biodiversity play an immensely critical role in ensuring the sustainability and ethicality of mining operations, emphasizing the paramount importance of responsible stewardship of natural resources and ecosystems.
- Climate Change: As the global focus intensifies on environmental sustainability and climate change, the significance of adaptation to climate change regulations and the implementation of effective mitigation strategies has substantially amplified, particularly within the realm of mining activities.

I.3.2 SWOT Analysis

the SWOT method, an acronym representing Strengths, Weaknesses, Opportunities, and Threats, presents an introspective analysis of the company's internal dynamics. By scrutinizing internal strengths and weaknesses along with external opportunities and threats, this method enables a holistic evaluation of PT VALE Indonesia's internal competencies, areas for improvement, potential growth prospects, and existing challenges. This introspective analysis sheds light on the company's strategic positioning, resources, capabilities, and areas necessitating strategic attention.

Strengths:

1. Global Reputation: PT. VALE is widely recognized and respected on a global scale, positioning itself as a prominent and influential entity within the nickel industry due to its extensive expertise, consistent performance, and established track record, garnering commendation and acknowledgment from industry peers, stakeholders, and market participants worldwide.
2. Technological Expertise: The company prides itself on the utilization of state-of-the-art mining technologies, which have been strategically integrated into their operational framework, thereby significantly augmenting the overall efficiency and productivity levels within their mining processes.



3. **Extensive Resource Reserves:** PT. VALE maintains a significant competitive advantage within the nickel industry owing to its possession of extensive and substantial nickel reserves, a strategic asset that not only fortifies its current status but also solidifies its position as a preeminent and influential nickel producer on both a domestic and global scale.
4. **Strategic Partnerships:** The establishment and maintenance of robust and mutually beneficial partnerships and collaborations with a diverse spectrum of local and global stakeholders, ranging from industry peers to governmental bodies and community organizations, significantly fortify and augment the company's market presence, amplifying its influence and reach within the industry and across various geographical domains.
5. **Environmentally Conscious Practices:** Placing a profound emphasis on the implementation and adherence to sustainable mining practices, coupled with a steadfast commitment towards upholding environmental responsibility, significantly augments and fortifies the corporate image of the company, thereby fostering a positive perception among stakeholders, including investors, customers, regulatory bodies, and local communities, and positioning the organization as a responsible entity committed to environmental preservation and ethical business conduct.

Weaknesses:

1. **Market Dependency:** The significant reliance placed on the trends and fluctuations of nickel prices within the global market introduces a notable vulnerability to the company, wherein the considerable dependency on these market dynamics exposes PT. VALE Indonesia to substantial risks and uncertainties stemming from the inherent volatility and fluctuations of nickel prices on a global scale.
2. **Operational Challenges:** The intricate and multifaceted operational environments prevailing within Indonesia's industrial landscape potentially engender a myriad of logistical challenges and intricate regulatory complexities for companies operating within the region.
3. **Cost Sensitivity:** During periods of market downturns, the financial viability and profitability of PT. VALE Indonesia could be substantially affected by various operational expenses, encompassing not only energy-related expenditures but also labor costs, both of which stand as pivotal components contributing to the overall operational expenses and subsequently influencing the company's financial performance.
4. **Limited Diversification:** The company's concentrated focus primarily on nickel production, while indicative of its specialized expertise in the field, also renders it susceptible to inherent sector-specific risks that arise from potential market fluctuations, demand shifts, and challenges specific to the nickel industry, thereby amplifying the company's vulnerability to the nuances and uncertainties prevailing within this particular sector.
5. **Infrastructure Development:** Obstacles and limitations faced in the realm of infrastructure development, encompassing factors such as inadequate transportation networks, deficient logistical facilities, and insufficiencies in essential infrastructural elements, have the potential to impede and disrupt the smooth and effective flow of transportation and logistics operations within PT. VALE Indonesia.

Opportunities:

1. **Growing Nickel Demand:** The rising global demand for electric vehicles, driven by the growing emphasis on sustainable transportation solutions and the increasing adoption of renewable energy sources to combat climate change, significantly amplifies the requirement for nickel, a crucial component in the manufacturing of batteries utilized in electric vehicles and various renewable energy technologies.
2. **Exploration and Expansion:** There are significant opportunities present for PT. VALE Indonesia to engage in exploration ventures and expand its operations into unexplored nickel reserves that remain untapped and hold the potential for substantial resource acquisition and subsequent production, thereby augmenting the company's market position and bolstering its long-term sustainability in the industry.



3. **Technological Advancements:** By strategically harnessing and integrating cutting-edge technological innovations, PT. VALE Indonesia can significantly augment its operational efficiency, streamline processes, and concurrently drive cost-effectiveness throughout its operations.
4. **Strategic Acquisitions:** The procurement of strategic assets or the establishment of partnerships presents an opportunity for PT. VALE Indonesia to broaden and diversify its portfolio, thereby potentially expanding its operational scope, enhancing its market presence, and mitigating risks associated with dependency on a singular line of business or product offering.
5. **Sustainability Initiatives:** Placing a heightened focus and prioritization on implementing and consistently upholding sustainable practices not only aligns with contemporary corporate social responsibility standards but also engenders a more robust foundation for building and nurturing positive, enduring relationships with stakeholders across various spheres including investors, local communities, regulatory bodies, and consumers.

Threats:

1. **Market Volatility:** The oscillations and inherent unpredictability observed in the global nickel prices, coupled with the dynamic shifts in market demand patterns, stand as pivotal factors that could potentially exert substantial adverse impacts on the company's revenue streams and overall financial performance.
2. **Regulatory Changes:** The continuous evolution and adaptation of government regulations in Indonesia, particularly within the realm of the mining industry, possess the potential to exert significant influence and ramifications on the operational landscape, practices, and ultimately, the profitability of mining entities operating within the country.
3. **Competitive Pressure:** The heightened levels of competition prevailing within the nickel industry have the potential to exert considerable downward pressures on pricing dynamics, thereby necessitating strategic maneuvers to navigate through market fluctuations and sustain profitability, while simultaneously posing challenges in terms of retaining and expanding market share amidst the competitive landscape.
4. **Environmental Risks:** The stringent and constantly evolving environmental regulations, coupled with the multifaceted risks inherent in mining activities such as ecological disruptions, potential biodiversity loss, soil and water contamination, habitat destruction, and the social implications on local communities, collectively pose substantial threats to the sustainable operations and reputation of the mining industry.
5. **Geopolitical Instability:** The presence of unresolved political complexities, coupled with ongoing geopolitical tensions prevailing within the region, holds the potential to significantly disrupt and impede the seamless continuation of operational activities for the company.

I.4 Business Issue

Indonesia, endowed with rich natural resources, stands as one of the world's major producers of nickel. The country boasts significant nickel reserves and has been a key player in the global nickel market. As of recent data, Indonesia holds substantial nickel reserves, estimated to be among the largest globally, with reserves concentrated mainly in Sulawesi, Halmahera, and other regions.

Nickel mining in Indonesia has experienced dynamic shifts in policies and regulations over the years, impacting its global position as a nickel producer. The government's initiatives and regulations concerning nickel ore exports and downstream processing have played a pivotal role in shaping the trajectory of Indonesia's nickel industry. Policies aiming to develop domestic processing facilities, such as the ban on nickel ore exports, have aimed to encourage local value addition and strengthen the nation's position in the global nickel supply chain.

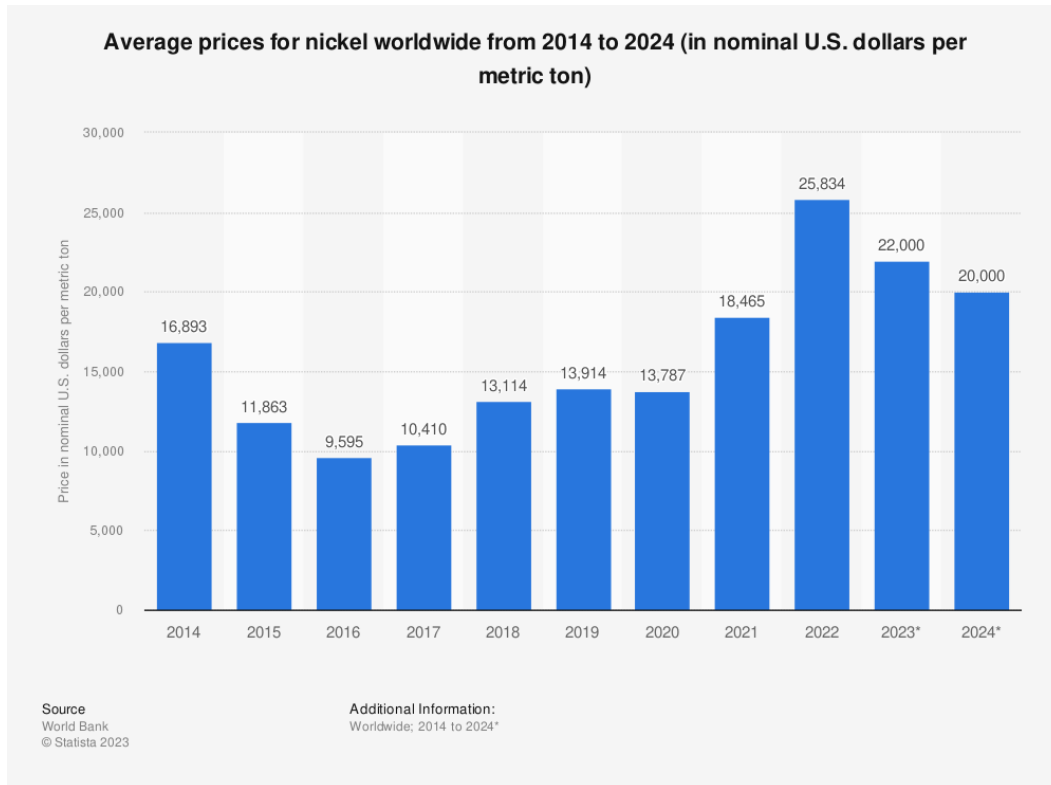


Figure 1. 3 Nickel Price Index from 2014-2024 (estimated)

Source: statista.com

President Joko Widodo, refused to comply with the warnings of the International Monetary Fund (IMF) or a potential lawsuit from the World Trade Organization (WTO) regarding nickel downstreaming/export banning regulation. In early July 2023, the IMF gave a note to Indonesia through the IMF Executive Board Concludes 2023 Article IV Consultation with Indonesia. In the document, the organization, which has 190 member countries, warns of further cost-benefit analysis, as well as plans to minimize cross-border spillovers if downstream nickel is carried out. Nickel downstream activities are processing raw nickel or nickel ore into final products that have added value and can be traded, so they have economic value.

The push for downstream nickel is in line with restrictions on exports of this commodity. The IMF also asked Indonesia to consider a policy of gradually eliminating restrictions on nickel exports. Currently, based on data from the Ministry of Industry, there are 34 smelters that are already operating and 17 smelters that are under construction. The investment invested in Indonesia is USD 11 billion or around IDR 165 trillion for the Pyrometallurgical smelter, and USD 2.8 billion or close to IDR 40 trillion for the three Hydrometallurgical smelters which will produce MHP (Mix Hydro Precipitate) as battery raw material.

The downstream program is able to boost Indonesia's economic performance, even becoming one of the best among the G20 member countries. Through economic transformation efforts, Indonesia will be able to realize the Golden Indonesia Vision 2045. By downstreaming, the value of exports originating from nickel will increase many times over. The export value of nickel ore and its derivatives in 2013 only reached USD 5.4 billion. Then, through the downstream policy, the export value of nickel derivatives in 2022 will reach USD35.6 billion or 6.6x higher.

The magnitude of the multiplier effect of this nickel smelter can be seen from the added value. The Ministry of Industry calculates that the added value produced from nickel ore to downstream products increases many times if it is processed



domestically or eliminates the processing of raw goods. If the value of raw nickel ore is valued at USD 30/ton, when it becomes Nickel Pig Iron (NPI) the price will increase 3.3 times to reach USD 90/ton. Meanwhile, if it becomes ferronickel, it will increase 6.76 times or the equivalent of USD203/ton.

When downstreaming continues to produce Matte Nickel, the added value will also increase to 43.9 times or USD3,117/ton. Moreover, now Indonesia has a smelter which uses MHP as raw material for batteries with an added value of around 120.94 times (USD 3,628/ton). Moreover, if a battery factory converts ore into LiNiMnCo, the added value could reach 642 times.

This will certainly increase Non-Tax State Revenue (PNBP) and other taxes worth trillions of rupiah. From this alone it has been proven, as stated by the President, if we export raw materials, the figure is IDR 17 trillion, compared to exports of nickel downstream products, which reach IDR 510 trillion. So that state revenue from taxes will increase much more.

The decline in nickel prices from its peak in 2022 has extensive implications across various sectors, particularly in the mining industry, a nation's economy, and companies involved in nickel production. As nickel prices decrease, mining companies experience a reduction in revenue, impacting their ability to operate optimally, invest in new technologies, or develop mining infrastructure.

Nations reliant on nickel exports, such as Indonesia, will face the brunt of reduced national income and potential disturbances in their trade balances. The global industry and markets also feel the effects, as the decrease in nickel prices affects companies' profitability, business strategies, and even markets that use nickel as a raw material for their products.

Fluctuations in nickel prices are part of commodity market dynamics that lead to adjustments across various economic sectors, consequently affecting a company's operations, a nation's economy, and the global market.

I.5 Research Question and Research Objective

This research will analyze several business issues regarding PT Vale Indonesia. Among others are:

1. How to predict the world nickel price in the future?
2. What will PT Vale Indonesia's valuation be like in the future?
3. Is PT Vale still a good investment for its investors in the future for the investors?

So, there are several objectives of this research to identify the relationship between future nickel prices, PT Vale's share price, and strategies to obtain returns for its investors. What needs to be done is as follows:

1. Identify future nickel prices
2. Analyze the financial statements and valuation of PT Vale Indonesia
3. Analyze the price prospects of PT Vale Indonesia

I.6 Research Scope and Limitation

This research will focus on PT Vale Indonesia as one of the market leaders in the nickel mining industry which has gone public on the stock exchange. This research will focus on financial statement analysis and valuation using historical data. The data that will be used is financial data for the last five years, namely 2018 to 2022. Another limitation is regulations that may change and nickel price predictions that also fluctuate.

II. LITERATURE REVIEW

II.1 Theoretical Foundation

II.1.1 Financial Statement Analysis

Financial statement analysis is a method of reviewing and analysing a company's accounting reports (financial statements) in order to gauge its past, present, or projected future performance (j. Prasoon, 2021). Financial statement



analysis is a series of steps taken by an individual to examine and evaluate various financial documents of a company with the aim of making informed decisions regarding the business.

While the specific content within each financial report varies from one company to another, each document is designed to provide in-depth insights into the company's health. These documents play a crucial role in monitoring the company's performance over time and understanding how the company progresses towards its key strategic initiatives. Careful analysis of these financial statements enables stakeholders to comprehend the company's financial position holistically, thereby facilitating decision-making concerning investments, business strategies, and long-term planning.

In general, there are two common methods conducted by professional to analyze The Financial Statement: Vertical and Horizontal analysis, and ratio analysis (HBS.edu, 2019).

1. Vertical analysis involves scrutinizing a singular column within a financial statement. Unlike horizontal analysis, which tracks trends across different reporting periods, vertical analysis focuses on establishing the relationship between specific line items within a statement. For instance, within an income statement, each line item might be depicted as a percentage of the gross sales figure. While horizontal analysis concentrates on the examination of current financial data in contrast to previous reporting periods, often termed as "trend analysis," it enables individuals to gauge the shifts in various financial indicators over time. For instance, it allows for the observation of fluctuations in liabilities between Q1 and Q2.
2. Ratio analysis involves scrutinizing the data within a financial statement concerning another set of data within the same report, thereby providing a comparative perspective on various aspects of a company's financial health.

Within ratio analysis, there exist diverse categories of ratios that contribute to understanding a company's condition comprehensively. These categories can be broadly classified as follows:

- a. Profitability Ratios: These ratios shed light on a company's ability to generate profits. Crucial profitability ratios encompass the gross profit ratio, return on equity, break-even point, and return on net assets.
- b. Liquidity Ratios: These ratios gauge a company's liquidity, a vital factor in assessing its operational sustainability. Key liquidity ratios encompass the cash coverage ratio, current ratio, and liquidity index.
- c. Leverage Ratios: These ratios offer insights into a company's reliance on debt to sustain its operations. Essential leverage ratios comprise the debt to equity ratio, debt service coverage ratio, and fixed charge coverage.
- d. Activity Ratios: These ratios delve into a company's efficiency in resource utilization. Significant activity ratios encompass the accounts payable turnover rate, accounts receivable turnover rate, inventory turnover rate, and working capital turnover rate.

II.1.2 Financial Ratios

Liquidity is measured by its ability to satisfy its short-term obligations as they come due (Gitman & Zutter, 2015). Liquidity characterizes the level of efficiency or ease in converting an asset or security into readily available cash without causing a significant impact on its market value. Among all assets, cash stands as the epitome of liquidity, providing immediate convertibility. Therefore, the accessibility of cash for such conversions significantly determines the market's capacity to operate smoothly. (Gitman & Zutter, 2015)

Assets with higher liquidity possess greater ease and efficiency in their transformation into cash. Conversely, assets with lower liquidity necessitate more time and might incur higher costs during conversion processes. This distinction in liquidity levels affects the speed and convenience of asset conversion into cash, thereby influencing market operations and financial transactions.



Activity ratio categorized as a financial indicator, serves as a yardstick to measure the effectiveness of a company's utilization of assets listed on its balance sheet in generating revenue and cash flow. Specifically, activity ratios measure the speed with which various accounts are converted into sales or cash, or inflows or outflows (Gitman & Zutter, 2015). Often termed as efficiency ratios, these activity ratios provide valuable insights for analysts to assess a company's proficiency in managing its inventory, a critical aspect influencing its operational agility and overall financial well-being.

These ratios are instrumental in evaluating the company's efficiency in converting its assets into revenue streams. By scrutinizing how swiftly inventory is turned over or how effectively accounts receivable are collected, analysts can draw conclusions about the company's operational efficiency and effectiveness in utilizing its resources. Activity ratios offer a lens through which to observe how adeptly a company leverages its assets to generate income, thus painting a clearer picture of its operational strengths and areas for potential improvement.

The debt portion of a firm indicates the amount of other people's money being used to generate profits (Gitman & Zutter, 2015). Debt refers to an obligation, typically financial, owed from one entity to another. It serves as a tool utilized by numerous individuals and organizations to facilitate substantial acquisitions that might not be feasible through alternative means. The more debt a firm uses in relation to its total assets, the greater its financial leverage (Gitman & Zutter, 2015). Businesses often resort to incurring debt to finance significant investments or expenditures that surpass their current financial capacity. This borrowed capital enables them to acquire assets, properties, or services that might otherwise be beyond their immediate financial reach. In the debt ratio, there are several methods to assess the company's liquidity such as debt-to-equity ratio (DER) and interest coverage ratio.

Profitability ratio enable to evaluate the firm's profits with respect to a given level of sales, a certain level of assets, or the owners investment (Gitman & Zutter, 2015). Profitability ratios belong to a group of financial indicators utilized to evaluate a company's capability to generate profits concerning various aspects such as revenue, operational expenses, assets outlined in the balance sheet, or the shareholders' equity. These metrics offer insights into the company's earnings generation potential at a particular moment and track how this capability evolves over time. They are instrumental in analyzing the relationship between a company's income and the resources, costs, or investments involved in generating that income, providing a snapshot of its financial performance and efficiency at a specific point in time. Some methods that are common to measure profitability ratio are gross profit margin, operating profit, margin, net profit margin, return on assets (ROA), and return on equity (ROE).

Market ratios relate the firm's market value, as measured by its current share price, to certain accounting values (Gitman & Zutter, 2015). The market ratio serves as a tool, offering investors the necessary insights to conduct a comprehensive analysis of the market landscape and assess how a company's endeavors translate into returns on the invested capital. By delving into market ratios, investors gain a deeper understanding of the dynamics and performance indicators within the market in which a company operates.

II.1.3 Pro Forma Analysis

When Pro Forma integrated into financial statements, it signifies the utilization of specific projections or assumptions in computing financial results. Pro forma financials typically deviate from generally accepted accounting principles (GAAP) and often exclude exceptional expenses that fall outside the realm of routine business operations, such as expenses linked to post-merger restructuring (Investopedia.com, 2023).

Pro forma financial information shows what the significant effects on historical financial information might have been had a consummated or proposed transaction or event occurred at an earlier date (AICPA, 2019). A pro forma financial statement has the flexibility to omit elements that a company deems could obscure the accuracy of its financial forecast.



This selective approach allows companies to present a tailored view of their financial position, aiming to provide a clearer insight into the company's anticipated financial performance.

By excluding non-recurring expenses and certain items deemed as potentially distorting the financial picture, pro forma financials serve as a tool to aid in evaluating a company's future trajectory. They offer a modified perspective that focuses on the core operational aspects and aids in projecting a more streamlined and optimistic future outlook. This information can be valuable for stakeholders seeking a nuanced understanding of a company's potential growth and financial direction. These are necessary steps to conduct a proforma analysis:

1. Determine the business's expected revenue by using pro forma forecasting. This involves making realistic predictions based on market conditions. Sometimes, consulting experts and accountants is necessary to understand typical yearly income and assumptions regarding asset accumulation.
2. Figure out the overall liabilities and expenses, including loans, lines of credit, lease payments, utilities, employee salaries, insurance, licenses, permits, materials, and taxes.
3. Combine the revenue projections from the first step with the total costs from the second step to build the initial segment of your pro forma. This part will forecast the future net income (NI).
4. Estimate cash flows, focusing on how the proposed business changes will affect the cash position. Cash flow varies from net income because certain revenues and expenses might be recorded before or after actual cash transactions occur, as per accrual accounting principles.

However, pro forma analysis is quite limited due to its dependence on assumptions and predictions. It is possible that these may vary due to unforeseen events, operational limitations, and market changes.

II.1.4 Valuation

A business valuation, also known as a company valuation, is the process of determining the economic value of a business (Investopedia.com, 2023). Business valuation refers to the process of assessing the economic worth of a business entity or a specific business unit. The evaluation of a business's value serves multifaceted purposes, including but not limited to determining its fair value for diverse scenarios like potential sale, delineating ownership stakes among partners, considerations related to taxation, and even during legal procedures like divorce settlements. The enterprise value is the value of operating assets of the company (Luca, 2018).

Numerous methodologies and approaches are employed to ascertain the value of a business. These methodologies encompass a spectrum of techniques, ranging from analyzing its market capitalization, applying earnings multipliers, to scrutinizing its book value, among other methods. Each approach holds its unique set of considerations, assumptions, and implications, offering distinct insights into the financial standing and potential worth of the business entity.

Market capitalization assessment involves evaluating the total market value of a business based on its outstanding shares and market price per share. Conversely, earnings multipliers delve into the relationship between a business's earnings and its overall value, providing a perspective on its income-generating capacity. Meanwhile, the book value method examines the net worth of the company by comparing its total assets against liabilities, portraying a snapshot of the company's financial position. Some methods to use in this research are following:

1. Discounted Cash Flow (DCF) analysis stands as an evaluative technique employed to appraise the worth of an investment by considering its anticipated future cash inflows. This method centers on estimating the present value of an investment by projecting the prospective cash flows it is expected to generate.
2. The primary objective of DCF analysis is to ascertain the current value of an investment by extrapolating its future income potential. In other words, DCF analysis approach expresses the value of the company or an investment as a function of the expected returns it generates (M (<https://dataindonesia.id>, 2023)assari, Gianfrate, Zanetti, 2016). This evaluation proves beneficial for potential acquirers contemplating the purchase of a company or securities.



Moreover, it aids business proprietors and managers in making informed decisions pertaining to capital budgeting and operational expenditures.

An assessment of the viability of an investment opportunity can be deduced from the comparison between the calculated DCF and the current cost of the investment. If the DCF surpasses the current investment cost, it implies the potential for positive returns, thereby rendering the opportunity potentially worthwhile.

To establish the discount rate utilized in the DCF analysis, companies often resort to the weighted average cost of capital (WACC). The choice of WACC is rooted in its ability to account for the anticipated rate of return desired by shareholders, thereby encompassing various sources of capital.

3. Competitors in the same industry. This approach is empirical valuation that performed through a comparison with comparable assets traded on the market (Massari, Gianfrate, Zanetti, 2016). This approach will be use Price-to-Earnings Ratio, Price-to-Sales ratio, and Price-to-Book ratio, which will be compared with similar competing companies operating in the nickel mining sector. By analyzing the ratio above, investors can find out how much value PT VALE brings compared to similar competitors in the same industry.
4. Multiples approach analysis: The multiples approach stands as a valuation methodology grounded in the principle that akin assets command comparable prices in the market. This approach operates on the premise that when comparing firms, the ratios employed—be it operating margins, cash flows, or other metrics—are analogous across similar entities.

Referred to interchangeably as multiples analysis or valuation multiples, the multiples approach remains a favored strategy among investors seeking comprehensive insights into a company's worth. Within this framework, investors often draw reference to diverse financial ratios, with popular examples including the price-to-earnings (P/E) ratio, price to sales, or the enterprise value-to-EBITDA ratio, among others, all of which serve as examples of earnings multiples.

This method hinges on the assumption that comparable companies, operating within similar industries or with analogous business models, tend to exhibit similar financial traits. By leveraging these multiples or ratios derived from financial metrics, investors aim to glean a deeper understanding of a company's valuation and potential growth prospects. The use of earnings multiples facilitates a comparative analysis, allowing investors to gauge a company's performance in relation to its peers and industry standards, thus aiding in the formulation of informed investment decisions.

The multiples approach not only provides a snapshot of a company's valuation at a given point in time but also assists in forecasting future market trends. By applying this method, investors gain a nuanced perspective on a company's financial health, identifying strengths, weaknesses, and growth opportunities within the broader market context. This multifaceted analysis allows for a more comprehensive assessment, steering investors towards potential investment opportunities while considering the intrinsic value of the company vis-à-vis industry benchmarks.

5. Cost of Capital approach is the enterprise value on the basis of Free Cash Flow from operations discounted at a cost of capital by considering either the cost of equity and the cost of debt (Luca, 2018). This approach encompasses the comprehensive inclusion of all financing sources within the calculation, with each source assigned a weight corresponding to its proportionate contribution within the company's capital structure. The cost of capital approach is more useful in the case of ongoing company evaluation characterized by a sustainable capital structure (Luca, 2018). This methodological approach acknowledges the varying costs associated with different types of financing and underscores the significance of each source within the broader financial framework of the company. WACC provides a balanced and comprehensive overview, taking into account both the cost and the proportion of each funding source in determining the company's overall cost of capital.

II.2 Multiplies in Enterprise Value

II.2.1 Price-to-Earnings Ratio (P/E)

The price-to-earnings (P/E) ratio establishes a connection between a company's stock price and its earnings per share, presenting a vital metric for investors to gauge a company's valuation in the market. The price-to-earnings (PE) ratio is the most used multiple to estimate equity value (Luca, 2018). A high P/E ratio often signifies that the stock might be overpriced relative to its earnings or indicates investors' anticipation of substantial future growth prospects.

When a company lacks earnings or operates at a loss, the absence of earnings results in an undefined or non-existent P/E ratio. This scenario emerges because there are no earnings available to place in the denominator, rendering the calculation impractical.

In practical investment analysis, two primary forms of P/E ratios come into play: the forward P/E ratio and the trailing P/E ratio. The forward P/E ratio accounts for future earnings projections, incorporating expected earnings estimates, thereby offering insights into how the market perceives a company's future potential. On the other hand, the trailing P/E ratio utilizes historical earnings data, reflecting past performance and offering a retrospective view of a company's valuation based on its prior earnings.

II.2.2 Sensitivity Analysis

Sensitivity analyses are carried out with the final aim of studying the variation in these key expected results following the modification of the hypotheses underlying the business plan (Massari, Gianfrate, Zanetti, 2016). Through the establishment of a specific array of variables, an analyst possesses the capability to ascertain the impact of alterations in one variable on the overall outcome. The comprehensive exploration of both the target variable, also known as the dependent variable, and the input variable, referred to as the independent variable, constitutes a fundamental aspect of conducting sensitivity analysis. This analytical process involves a thorough examination not only of how these variables fluctuate but also of the consequential influence exerted by changes in the input variable on the target variable. By comprehensively dissecting the reciprocal relationship between these variables, analysts gain valuable insights into the sensitivity and responsiveness of the target variable to variations in the input variable. This detailed scrutiny aids in making informed decisions and predictions based on the observed interactions between these crucial parameters.

II.3 Conceptual Framework

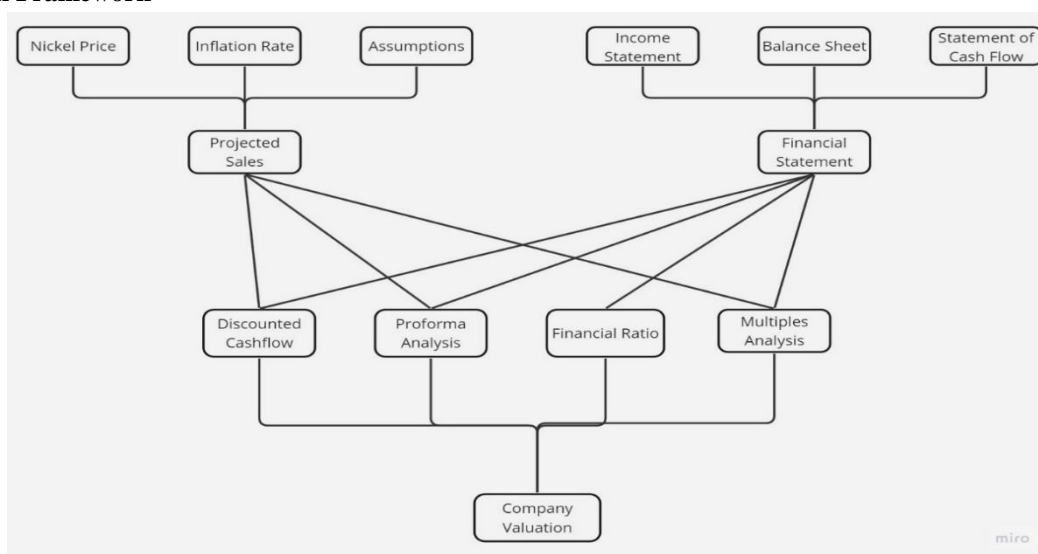


Figure 2. 1 The Conceptual Framework of the Research

The primary objective of this study revolves around conducting a comprehensive assessment of PT VALE Indonesia's company valuation. The methodology employed in this valuation process encompasses the utilization of various key determinants,



notably Nickel Price, Inflation Rate, and a range of Assumptions, all of which are pivotal in estimating Projected Sales. The evaluation of PT VALE Indonesia's Financial Statement is based on the comprehensive analysis of the Annual Report released in 2023, specifically focusing on the Company's performance throughout the fiscal year of 2022.

It's imperative to underscore that the analysis intertwines the projected sales estimation and the detailed scrutiny of the financial statements. These elements are pivotal in formulating a robust valuation framework that integrates various methodologies such as Discounted Cashflow, Proforma Analysis, Financial Ratio analysis, and Multiples Analysis. These analytical techniques are systematically employed to unravel a holistic perspective of PT VALE Indonesia's intrinsic worth in the market landscape.

The method employed in determining nickel prices will utilize the Rapidminer tool to process data. The author will employ Linear Regression, Neural Net, and Deep Learning methods and compare the three to find the smallest Root Mean Square Error (RMSE), involving variables such as the consumption of nickel worldwide, global coal production and consumption, world crude steel production, the growing global market share of Electric Vehicles (EVs), as well as the combined consumer and government expenditures on electric cars.

In the pursuit of forecasting nickel production and sales, the author employs the Compound Annual Growth Rate (CAGR) methodology. The substantial absorption of nickel production and sales by the company results in their CAGRs closely aligning with each other. This correlation arises from the nearly complete integration between production and sales activities within the company's operations. As a consequence, the CAGR analysis becomes an efficient and effective tool for anticipating future trends and projections in both nickel production and sales, fostering a comprehensive understanding of the company's market dynamics and growth trajectories.

The culmination of this multifaceted analysis, integrating both the Projected Sales and the comprehensive scrutiny of Financial Statements, aims to derive an accurate and holistic portrayal of PT VALE Indonesia's valuation within the industry context. To conduct a comprehensive projection of a company's future performance, the author will employ the method of proforma analysis, building upon insights gleaned from prior analyses. Proforma analysis stands as a robust tool capable of offering a holistic overview of a company's performance, serving the interests of both internal stakeholders and external parties such as shareholders. The utilization of proforma analysis in this research endeavor underscores its significance in facilitating informed assessments of a company's prospects, thereby contributing to a more robust understanding of its future trajectory.

III. METHODOLOGY

Research methodology refers to the systematic approach and framework utilized in conducting an academic inquiry or investigation. It delineates the comprehensive strategy adopted to gather, interpret, and analyze data, thereby answering research questions or achieving research objectives. The methodology encapsulates various elements, including the research design, data collection methods, data analysis techniques, and ethical considerations. It serves as the roadmap guiding the researcher throughout the study, ensuring rigor, validity, and reliability in the research process. The choice of methodology hinges upon the nature of the research, its objectives, and the type of data required. An explicit and well-defined research methodology not only substantiates the credibility of the research findings but also allows for the replication of the study by other researchers, thereby contributing to the advancement of knowledge within the respective field of study.

This study endeavors to conduct a comprehensive analysis of the valuation of PT VALE Indonesia, especially in the context of the regulatory shifts concerning nickel downstream operations imposed by the Government. This evaluation becomes particularly pertinent given the company's pivotal role as a significant supplier of nickel raw materials on a global scale. Additionally, the analysis takes into account the prevailing high demand for nickel alongside the discernible downward trajectory observed in the world nickel prices.

The primary dataset utilized to gauge the fluctuations in world nickel prices stems from the London Metal Exchange (LME), spanning a substantial timeframe from 2018 through 2023. The inclusion of this extensive temporal range aims to capture nuanced trends and fluctuations, providing a comprehensive backdrop for the valuation analysis.

To achieve a robust evaluation, this research employs a multifaceted approach encompassing various analytical methodologies. Primarily, it leverages financial statement analysis, delving into the company's fiscal records to discern patterns and insights into its financial health and performance. The research employs valuation analysis methodologies to ascertain the intrinsic value of PT VALE Indonesia within the context of the complex dynamics involving downstream nickel regulations, global market demands, and the fluctuating nickel prices.

III.1 Research Design

The research design refers to the systematic steps outlining the methodological framework employed to address the research objectives effectively. It encompasses the overall structure, approach, and strategies utilized to conduct the study, including the selection of data sources, data collection methods, analytical techniques, and the overall framework for data analysis. A well-defined research design ensures the systematic and rigorous investigation of the chosen research problem, providing a clear roadmap for gathering, analyzing, and interpreting data while maintaining methodological rigor and validity in the research process.

This research adopts a systematic approach encompassing multiple sequential steps aimed at deriving comprehensive conclusions and recommendations. Initially, an extensive exploration of pertinent business issues was conducted, encompassing multifaceted aspects such as the persistent downward trajectory observed in world nickel prices, Indonesia's prominent position as a major global nickel producer, the regulatory landscape concerning nickel downstream operations imposed by the Indonesian government, and the discernible trend of share price fluctuations among publicly traded nickel companies, particularly in Indonesia. Subsequently, the researchers formulated a precise research question, delineating the primary aim and scope of this investigation. The research progressed by delving deeper into a root cause analysis, systematically dissecting the underlying factors driving the identified business issues. This was complemented by an exhaustive review of pertinent literature, examining and synthesizing various analytical tools employed in similar contexts within the business realm. A comprehensive overview of the research methodology to be employed was outlined, detailing the systematic approach to data collection, analysis, and interpretation. Subsequently, a meticulous analysis of the gathered findings was conducted, aiming to derive nuanced insights and patterns from the amassed data. As this study culminates, the researchers endeavor to formulate conclusive insights and actionable solutions specifically tailored to address the identified issues and leverage opportunities for PT VALE Indonesia, drawing upon the comprehensive findings elucidated throughout this research endeavor.

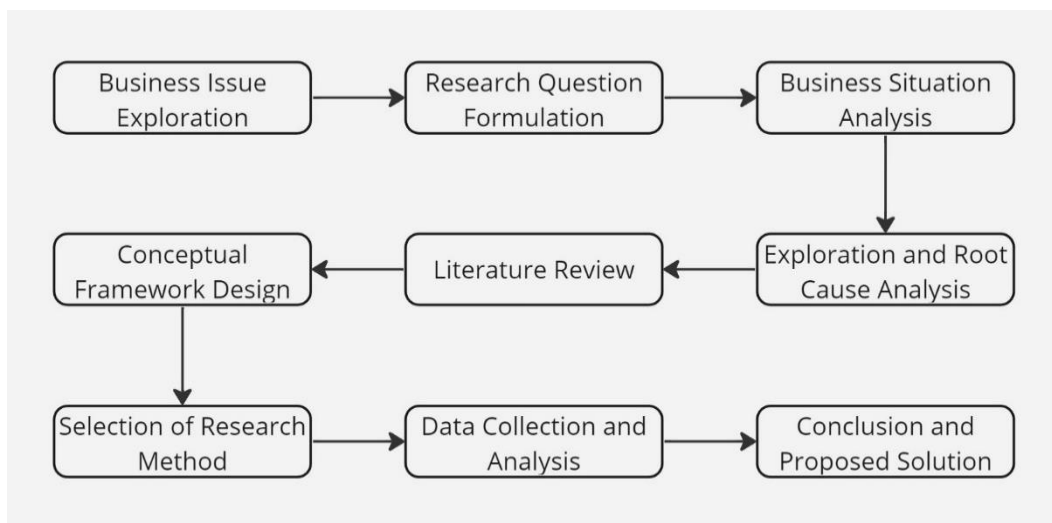


Figure 2. 2 The Research Design Process



III.2 Quantitative Method Research

Quantitative approach construes analysis of an idea by establishing narrow assumptions and using data gathering so support or controvert the assumptions (Creswell, 2014). Quantitative research involves a meticulous process of collecting and analyzing numerical data. It encompasses not only the gathering of data but also a thorough analysis to uncover patterns, compute averages, make predictions based on existing data, test and assess cause-and-effect relationships, and subsequently generalize findings from the sampled data to a broader population. Thus, quantitative research provides a robust foundation for decision-making by utilizing systematic and detailed data analysis to offer a more comprehensive understanding of the studied phenomena.

This study leans heavily on the utilization of secondary data sources, comprising an amalgamation of global market data and financial records from the involved companies. The data collection process for benchmark nickel prices spans a comprehensive ten-year period and draws upon information gathered from the reputable London Metal Exchange (LME). These extensive records encapsulate a substantial historical context, providing a nuanced perspective on the fluctuations and trends within the nickel market over an extended duration. Moreover, the financial data utilized in this research stems directly from the formal Financial Reports, a mandatory submission by each company to the Indonesia Stock Exchange (IDX). This approach ensures the reliability and authenticity of the financial information, fostering a robust foundation for the ensuing analyses. All accumulated data undergoes rigorous scrutiny and analysis in alignment with the meticulously outlined research methodology expounded in the preceding subsections. This methodological framework delineates the systematic approach to data processing, analysis, and interpretation, ensuring the integrity and validity of the research findings.

III.3 Data Analysis

III.3.1 Nickel Price

The prices of minerals and metals in Indonesia are regulated by government regulations established by the Ministry of Energy and Mineral Resources of the Republic of Indonesia. The pricing of nickel in Indonesia is based on a reference price determined by the Minister of Energy and Mineral Resources of the Republic of Indonesia under Decision Number 2946 K/30/MEM/2017 regarding the Formula for Determining the Metal Mineral Benchmark Price (MBP), subsequently translated into the Reference Mineral Prices (RMP) each month with reference to the London Metal Exchange (LME).

The formula utilized by the Ministry of Energy and Mineral Resources is as follows:

$$RMP = \frac{(n - 30) + (n - 29) + (n - 28) + \dots + (n - 1)}{n}$$

RMP = Reference of Mineral Price

n = Nickel metal prices in cash seller and settlement published by the London Metal Exchange (LME)

The regulation issued by the Minister of Energy and Mineral Resources of the Republic of Indonesia under Decision Number 2946 K/30/MEM/2017 stipulates the benchmark price for Nickel-Matte, which happens to be the primary product of PT VALE Indonesia, as follows:

$$MBP \text{ of Nickel Matte} = e \times (\%Ni + \%Co) \times \frac{(n - 30) + (n - 29) + (n - 28) + \dots + (n - 1)}{n}$$

MBP = Metal & Mineral Benchmark Price

e = The constant set by the Ministry of Energy and Mineral Resources is 78%

Ni = %Ni content in Matte Nickel

Co = %Co Content in Matte Nickel

n = Nickel metal prices in cash seller and settlement published by the London Metal Exchange (LME)

However, to predict nickel prices until 2030, this research uses the Prediction model using Rapidminer tool Utilizing the methodologies of Linear Regression, Deep Learning, and Neural Networks to ascertain the lowest Root Mean



Square Error (RMSE), the subsequent step involves applying these models while incorporating the following variables in historical data, including:

1. Global Nickel production
2. Global Nickel demand
3. World Nickel price
4. Global Coal production
5. Global Coal demand
6. World Coal price
7. Global Steel production
8. Global Steel demand
9. World Steel price
10. Global EV Sales

III.3.2 Production and Sales Growth

The methodology adopted for estimating production and sales revolves around the Compound Annual Growth Rate (CAGR). CAGR proves to be a robust analytical tool widely employed in forecasting future trends by computing the smooth annual growth rate over a specified period. Its application in this context involves analyzing historical production and sales data to project and anticipate future performance trajectories. By leveraging CAGR, this research aims to provide a reliable forecast of production and sales figures, contributing to a more nuanced understanding of potential growth patterns and facilitating informed decision-making processes for stakeholders and industry analysts. The formula for CAGR is as below:

$$CAGR = \left(\frac{V_{final}}{V_{begin}} \right)^{1/t} - 1$$

CAGR = Compound Annual Growth Rate

V_{begin} = Begin value

V_{final} = Final value

t = time in years

III.3.3 Financial Ratio

Financial ratios are quantitative metrics used to assess and evaluate various aspects of a company's financial performance, health, and efficiency. These ratios are derived from data found in financial statements like the balance sheet, income statement, and cash flow statement. They offer insights into different facets of a company's operations, including profitability, liquidity, solvency, efficiency, and market valuation.

The following formula is utilized for the purpose of this research:

Current Ratio

$$CurrentRatio = \frac{CurrentAssets}{CurrentLiability}$$

Quick Ratio

$$QuickRatio = \frac{CurrentAssets - Inventory}{CurrentLiability}$$

Cash Ratio

$$CashRatio = \frac{Cash + CashEquivalent}{CurrentLiability}$$

Gross Profit Margin

$$GrossProfitMargin = \frac{GrossProfit}{Revenue} \times 100\%$$



Operating Profit Margin

$$\text{OperatingProfitMargin} = \frac{\text{OperatingProfit}}{\text{Revenue}} \times 100\%$$

Net Profit Margin

$$\text{NetProfitMargin} = \frac{\text{NetProfit}}{\text{Revenue}} \times 100\%$$

Return on Assets (ROA)

$$\text{ReturnonAssets} = \frac{\text{NetIncome}}{\text{TotalAssets}} \times 100$$

Return on Equity (ROE)

$$\text{ReturnonEquity} = \frac{\text{NetIncome}}{\text{TotalEquity}} \times 100$$

Debt to Equity Ratio

$$\text{DebttoEquityRatio} = \frac{\text{TotalDebt}}{\text{ShareholderEquity}}$$

Debt Ratio

$$\text{DebtRatio} = \frac{\text{TotalDebt}}{\text{TotalAssets}}$$

Interest Coverage Ratio

$$\text{InterestCoverageRatio} = \frac{\text{EBIT}}{\text{InterestExpense}}$$

Efficiency Ratio

$$\text{InterestCoverageRatio} = \frac{\text{TotalExpenses} - \text{InterestExpense}}{\text{Revenue}}$$

Inventory Turnover Ratio

$$\text{InventoryTurnoverRatio} = \frac{\text{CostofGoodsSold}}{\text{AverageInventory}}$$

Account Receivable Turnover

$$\text{AccountReceivableTurnover} = \frac{\text{NetCreditSales}}{\text{AverageAccountReceivable}}$$

Asset Turnover Ratio

$$\text{AssetTurnoverRatio} = \frac{\text{Revenue}}{\text{AverageTotalAssets}}$$

III.3.3 Cost of Goods Sold and Expenses

In this research, the Cost of Goods Sold (COGS) is calculated as a percentage of revenue against the Gross Profit Margin (expressed in %). As the forecasted revenue can be obtained using the Compound Annual Growth Rate (CAGR), the COGS can be computed using the following formula:

$$\text{COGS} = \frac{\text{GrossProfitMargin}\% \times \text{Revenue}}{\text{Revenue}}$$

To calculate expenses, the author conducts a search for forecasted EBIT (Earnings Before Interest and Taxes). Once the EBIT is determined, it is then subtracted from the Gross Profit to yield the expenses for each period. The formulation used is as follows:

$$\text{Expenses} = \text{EarningBeforeIncomeTax} - \text{GrossProfit}$$



III.3.4 Free Cash Flow of PT VALE Indonesia

Free cash flow (FCF) stands as a residual amount within a company's financial framework, representing the funds remaining subsequent to fulfilling operational expenses (OpEx) and capital expenditures (CapEx). This surplus amount serves as a crucial indicator of a company's financial flexibility and ability to undertake various strategic initiatives. A higher FCF empowers companies to allocate resources towards dividend payments, debt reduction, and fostering growth prospects. There exist diverse methodologies for computing FCF, encompassing approaches utilizing operating cash flow, sales revenue, and net operating profits. It's essential to note that a declining FCF doesn't inherently signify adverse conditions; it may align with deliberate investment strategies aimed at fostering future growth. While FCF offers valuable insights into a company's financial robustness, other metrics such as return on investment (ROI), debt-to-equity (D/E) ratio, and earnings per share (EPS) collectively contribute to a comprehensive assessment of a company's financial health.

The Weighted Average Cost of Capital (WACC) is a crucial financial metric that encapsulates a company's overall cost of funding, considering both debt and equity components, each weighted proportionately. This metric serves as a comprehensive measure, calculated by multiplying the cost associated with each capital source by its respective weight in relation to the market value. The resultant values are then aggregated to derive the total WACC, providing a comprehensive understanding of the blended cost of capital utilized by the company. This metric holds significant importance for companies as it aids in assessing the efficiency of their financing strategies and in evaluating potential investment decisions by factoring in the cost implications of capital components.

$$r_a = (w_i \times r_i) + (w_p \times r_p) + (w_s \times r_{orn})$$

$$r_i = k_d \times (1 - t)$$

- r_a = Weighted Average Cost of Capital (WACC)
- w_i = Proportion of long-term debt in project capital structure
- r_i = Cost of Debt
- w_p = Proportion of Preferred Stock in Capital Structure
- r_p = Cost of Preferred Stock
- w_s = Proportion of Common Stock in Capital Structure
- r_{orn} = Cost of New Common Stock
- k_d = Long-Term Debt Interest Rate
- t = Corporate Tax Rate

III.3.4 Discounted Cash Flow (DCF)

The Discounted Cash Flow (DCF) analysis is a fundamental method utilized in academic research for evaluating the intrinsic value of an investment based on its expected future cash flows. This rigorous financial model involves projecting and discounting all anticipated cash flows generated by an investment over its lifespan to their present value, considering the time value of money.

The process begins by forecasting future cash flows, typically spanning several years, taking into account various factors such as revenue growth, operating expenses, capital expenditures, and terminal value estimations. These projections often involve thorough market research, industry trends analysis, and a comprehensive understanding of the company's operations and competitive landscape.

Once the cash flow projections are established, they are discounted back to present value using a discount rate, often determined by the cost of capital or the weighted average cost of capital (WACC). This discounting adjusts for the fact that a dollar received in the future is worth less than a dollar received today due to the opportunity cost and risk associated with waiting for the cash flow.



$$DCF = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_n}{(1+r)^n}$$

DCF = Discounted Cash Flow

CF_1 = The cash flow for year one

CF_2 = The cash flow for year two

CF_n = The cash flow for additional year

r = The discount rate

Once the Free Cash Flow (FCF) has been calculated, the subsequent step in this academic research involves the determination of the Terminal Value. Terminal Value plays a pivotal role in financial modeling and valuation methodologies, particularly in estimating the value of a company beyond the explicit forecast period. The formulation for Terminal Value is as follow:

$$TerminalValue = \frac{FCF_{n+1}}{(terminalgrowthrate - discountrate)}$$

IV. ANALYSIS

In this chapter, an extensive evaluation of PT VALE Indonesia's valuation will be undertaken by the researcher. The assessment of the company's valuation hinges upon an analysis from multiple dimensions, primarily anchored in the Company's prospective outlook. Given the speculative nature inherent in future occurrences, the valuation process necessitates the utilization of various assumptions due to the absence of available data or unforeseen events. One such pivotal assumption pertains to the prognostication of world nickel prices, a factor significantly impacting the company's operations due to its reliance on global nickel production and market pricing. The forecasted nickel prices will entail a simulation approach predicated on diverse factors intricately intertwined with the global demand for nickel.

IV.1 Assumptions

In the scope of this research endeavor, the authors confront certain limitations inherent in the accessibility and availability of secondary data, along with the inherent uncertainty of events that have not yet transpired. The impending prospect of changes, whether originating internally within the company's operations or emerging as external market dynamics, further contribute to the reliance on assumptions. These forward-looking assumptions become imperative to bridge the gap caused by the absence of concrete data or the unpredictability of forthcoming occurrences. The underlying assumptions encompass pivotal aspects such as the projection of global nickel benchmark prices, estimations of production growth or the anticipated Compound Annual Growth Rate (CAGR), and the estimation of Costs of Goods Sold (COGS) and Expenses. This estimation process crucially factors in the prevailing interest rates, amalgamating these assumptions to compensate for the dearth of current data or the uncertainties related to forthcoming occurrences, thereby ensuring a comprehensive analytical framework despite inherent limitations. Apart from that, the company currently has no debt. This adds to the assumption that in future capital expenditure, the company will purely use its resources to purchase fixed assets without applying for loans from external parties or increasing debt. Furthermore, the author also adopts an IDR 15,000 per USD approach for the analysis calculation, given that all sections detailing the financial statement are presented in USD currency in thousands of dollars.

IV.1.1 Nickel Price

Predicting nickel prices proves to be a challenging endeavor, influenced by multifaceted factors subject to the dynamics of supply and demand, as per economic theories. However, researchers have embarked upon leveraging predictive analytic methodologies to forecast global nickel prices. Employing the RapidMiner tool, the researchers endeavor to discern correlations between the world nickel price and a spectrum of key variables. These variables encompass the consumption of nickel worldwide, global coal production and consumption, world crude steel



production, the burgeoning global market share of Electric Vehicles (EVs), as well as the combined consumer and government expenditures on electric cars.

The utilization of this predictive analytics approach intends to unravel intricate relationships between these pivotal indicators and the fluctuation in nickel prices. This comprehensive analysis aims to untangle the intricate web of influences shaping the trajectory of nickel prices globally. By delving into these diverse variables, the researchers seek to construct a predictive model that illuminates potential trends and price estimations for nickel from the year 2023 through 2030.

Herein lies the forecasted trajectory of nickel prices based on the extensive examination of these critical variables, each carrying inherent implications for the global nickel market dynamics and, consequently, offering a potential insight into the future trends of this essential commodity.

Table IV. 1 The Estimated Nickel Price From 2023-2030

Year	Price
2023	29.357
2024	31.263
2025	31.774
2026	31.993
2027	32.160
2028	32.219
2029	32.208
2030	32.191

With the upward trajectory of nickel prices, correlating variables, and their sustained incline, there emerges the potential for a positive outlook in financial report analyses, extending forward possibly until 2030. This optimistic prospect is rooted in the dynamic correlation between nickel's market value and the multifaceted factors influencing its pricing, including but not limited to industrial demand, geopolitical dynamics, supply chain disruptions, and the evolving landscape of renewable energy technologies. Should these trends persist or experience further amplification, the financial assessments encapsulated within reports could foreseeably continue to exhibit a favorable trend, echoing the robustness and resilience of nickel's market dynamics through the upcoming decade. This assertion is further bolstered by the resilience historically exhibited by nickel pricing amidst market fluctuations, underpinning the credibility and reliability of financial projections, rendering them conducive for informed decision-making and strategic planning extending well into the foreseeable future, potentially until the year 2030.

IV.1.2 Production Growth in CAGR

PT VALE Indonesia has emerged as a prominent entity within the realm of nickel mining, positioning itself as a significant player in the industry subsequent to its initial public offering. The company's main revenue stream



predominantly stems from the sale of nickel matte, constituting a substantial portion of its overall earnings. Notably, the realized revenue for the fiscal year 2022 amounted to an impressive USD 1,179.45 million, signifying a remarkable ascent of 23.74% in comparison to the revenue realized in the preceding year of 2021.

It's noteworthy to highlight that PT VALE Indonesia has strategically cultivated a streamlined sales approach, channeling its production output solely towards Vale Canada Limited (VCL) and Sumitomo Metal Mining Co. Ltd. (SMM). This focused approach reflects the company's commitment to sustaining robust partnerships while also ensuring a consistent avenue for sales.

Moreover, delving into the trajectory of PT VALE Indonesia's production over the past decade unveils a comprehensive perspective even though the nickel price has quite fluctuated over time.

Table IV. 2 The nickel Production (In ton) by PT VALE Indonesia from 2012- 2022

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Q1	13.827	15.198	17.614	13.080	17.141	17.224	N/A	N/A	N/A	N/A	N/A
Q2	12.567	15.048	18.701	17.631	18.893	20.107	N/A	N/A	N/A	N/A	N/A
Q3	17.513	18.127	19.477	19.820	18.193	20.163	N/A	N/A	N/A	N/A	N/A
Q4	16.183	17.015	16.445	20.494	20.579	19.313	N/A	N/A	N/A	N/A	N/A
Total	60.090	65.388	72.237	71.025	74.806	76.807	77.581	81.177	78.726	75.802	70.717

Based on the comprehensive insights gleaned from the tabulated data above, a discernible trend emerges, revealing a consistent year-on-year decline in production figures. This downward trajectory in production levels raises pertinent concerns about the potential implications for PT VALE Indonesia's future performance. The Compound Annual Growth Rate (CAGR) of -1.79% starkly highlights this concerning pattern, indicating a sustained reduction in production rates over the specified duration. Such a negative CAGR not only underscores the ongoing decline in production but also signifies a persistent and adverse trend that could exert substantial pressures on the company's operational efficacy and overall performance in the foreseeable future. This declining production trajectory necessitates a thorough examination and strategic intervention to address the underlying factors contributing to this concerning trend and mitigate its potential impact on the company's long-term sustainability and growth prospects.

Table IV. 3 The Nickel Sales (In Ton) by PT VALE Indonesia from 2012-2022

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Q1	13.486	14.847	16.713	13.867	17.239	17.524	N/A	N/A	N/A	N/A	N/A
Q2	13.527	15.845	19.887	16.966	18.764	19.620	N/A	N/A	N/A	N/A	N/A
Q3	17.334	18.571	19.954	19.999	18.566	20.580	N/A	N/A	N/A	N/A	N/A
Q4	16.613	17.352	16.291	21.211	21.062	19.919	N/A	N/A	N/A	N/A	N/A
Total	60.960	66.615	72.845	72.043	75.631	77.643	78.976	82.907	79.477	77.198	71.379

Upon careful examination of the data provided in table above, a recurring trend of diminishing sales over consecutive years becomes apparent, potentially signaling a trajectory that could adversely impact the company's forthcoming financial performance. Notably, the Compound Annual Growth Rate (CAGR) of -1.74% mirrors a trend closely aligned with the CAGR of the company's nickel production. While this may initially appear as a concerning trend, it also presents an intriguing facet worthy of consideration. This alignment could be perceived as advantageous since it signifies the successful offloading of nearly the entirety of PT VALE's nickel production to its two key partners,



VCL and SMM. This strategic alignment between production and sales might indicate a focused and efficient sales strategy, ensuring a consistent market for the company's nickel output despite the declining sales trend, which could contribute positively to sustaining market presence and fostering lasting partnerships.

Based on the available dataset and the observed trend, it becomes evident that the Compound Annual Growth Rate (CAGR) of production closely aligns with that of sales for PT VALE Indonesia. This correlation in the growth rates between production and sales provides a foundational basis for making reasonable predictions regarding the company's future nickel production outcomes and sales performance. Leveraging this historical relationship serves as a fundamental assumption for projecting and estimating PT VALE Indonesia's prospective production figures and sales trajectory up to the year 2030. By extrapolating this correlation, the research aims to establish a predictive framework that forms the bedrock for subsequent methodological steps.

Table IV. 4 The prediction of nickel production growth from 2023-2030

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Q1	13.827	13.579	13.336	13.096	12.862	12.631	12.405	12.182	11.964
Q2	12.567	12.342	12.120	11.903	11.690	11.480	11.274	11.072	10.873
Q3	17.513	17.199	16.891	16.588	16.290	15.998	15.711	15.430	15.153
Q4	16.183	15.893	15.608	15.328	15.053	14.783	14.518	14.258	14.002
Total	60.090	59.013	57.954	56.915	55.895	54.892	53.908	52.942	51.992

Table IV. 5 The prediction of nickel sales growth from 2023-2030

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Q1	13.486	13.252	13.021	12.795	12.573	12.354	12.139	11.928	11.721
Q2	13.527	13.292	13.061	12.834	12.611	12.392	12.176	11.965	11.757
Q3	17.334	17.033	16.737	16.446	16.160	15.879	15.603	15.332	15.066
Q4	16.613	16.324	16.041	15.762	15.488	15.219	14.954	14.694	14.439
Total	60.960	59.901	58.860	57.837	56.832	55.844	54.873	53.920	52.983

IV.1.3 Cost Of Goods Sold and Operating Expenses

The Cost of Goods Sold (COGS) utilized in this scenario employs a moving average assumption derived from the Gross Profit Margin percentage over the past three years. This strategic approach stems from the discernible efficiency improvements witnessed by the company since 2021 in comparison to the performance in 2020. Consequently, including calculations from years preceding 2021 would lack relevance due to the established efficiencies achieved in managing both COGS and Operating Expenses. This adjustment enables a more precise



evaluation and projection of the current and future financial performance, accounting for the evolving operational efficiencies and their impact on cost structures within the organization.

IV.1.4 Other Assumptions

Within the framework of this research's valuation analysis, numerous assumptions have been instrumental in steering the evaluative process. These assumptions serve as pivotal benchmarks, effectively guiding the valuation methodology. Among the foundational assumptions meticulously integrated into the analysis, certain key aspects stand out prominently. First and foremost, the assumption predicates no occurrence of sales related to fixed assets within the evaluation period. This assumption not only delineates the scope of the valuation but also factors in the constancy of fixed asset holdings, a crucial element in the financial stability and asset base of the company under scrutiny.

The determination of corporate tax at a fixed rate of 22% forms another integral assumption. This fixed rate assumption seeks to standardize the tax liability projection, offering a simplified yet coherent perspective on the company's fiscal obligations within the valuation framework.

There is also assumption regarding depreciation, calculated on a straight-line basis, contributes significantly to the valuation model. This methodical approach to depreciation ensures a uniform and consistent depreciation expense over time, enabling a more foreseeable estimation of asset value decline within the financial assessment.

These assumptions, meticulously crafted and integrated into the valuation framework, serve as foundational pillars guiding the analysis, facilitating a more comprehensive and standardized evaluation of the company's financial standing and valuation.

IV.2 Financial Statement

The financial statements utilized in this research derive from the annual reports published by the company, presenting a chronological series of historical data spanning from 2018 through 2022. These annual reports, a rich source of comprehensive financial information, serve as the cornerstone for the empirical analysis conducted within this study. The utilization of annual reports as the primary source of financial data augments the research's credibility, as these documents are meticulously prepared, audited, and published in compliance with established accounting standards and regulatory requirements. Their reliability and adherence to accounting principles instill confidence in the accuracy and authenticity of the data used for analytical purposes.

IV.2.1 Income Statement

The following data exhibits the Income Statement of PT VALE Indonesia encompassing historical records spanning from 2018 through 2022:

Table IV. 6 Statement of Profit and Loss and Other Comprehensive Income (in thousands US\$)

Description	2022	2021	2020	2019	2018
Revenue	1.179.452	953.174	764.744	782.012	776.900
Cost of Revenue	- 865.885	- 704.323	- 640.365	- 665.558	- 672.899
Gross Profit	313.567	248.851	124.379	116.454	104.001
Operating Expense	- 19.734	- 17.691	- 7.385	- 13.730	- 11.578
Other Income	1.289	2.614	7.102	3.266	7.615
Other Expenses	- 23.093	- 10.750	- 20.242	- 17.701	- 15.184
Operating Profit	272.029	223.024	103.854	88.289	84.854
Net Finance Income/(Costs)	3.790	- 2.379	791	847	- 2.237



Profit Before Income Tax	275.819	220.645	104.645	89.136	82.617
Income Tax Expense	- 75.418	- 54.848	- 21.826	- 31.736	- 22.105
Profit For The Year	200.401	165.797	82.819	57.400	60.512
Other Comprehensive Income/(Loss)	- 82	1.404	- 4.134	566	3.848
Total Comprehensive Income For The Year	200.319	167.201	78.685	57.966	64.360

In the Income Statement, it can be inferred that there has been a consistent increase over the past five years at PT. VALE Indonesia. This trend is attributed to the upward trajectory of nickel prices from 2018 to 2022.

IV.2.2 Balance Sheet

Below is the balance sheet presented by PT VALE Indonesia in thousands of USD.

Table IV. 7 Report of Consolidated Financial Position (in thousand US\$)

Description	2022	2021	2020	2019	2018
Current Assets	989.802	836.576	695.972	588.313	630.998
Non-current Assets	1.668.314	1.636.252	1.618.686	1.634.375	1.571.454
Total Assets	2.658.116	2.472.828	2.314.658	2.222.688	2.202.452
Current Liabilities	175.039	168.430	160.710	136.552	175.340
Non-Current Liabilities	128.297	149.937	133.560	144.443	143.385
Total Liabilities	303.336	318.367	294.270	280.995	318.725
Total Equity	2.354.780	2.154.461	2.020.388	1.941.693	1.883.727
Total Liabilities and Equity	2.658.116	2.472.828	2.314.658	2.222.688	2.202.452

In this academic research, an elucidation of the balance sheet proffered by PT VALE Indonesia is instrumental in comprehending the company's financial position. The balance sheet, a vital financial statement, encapsulates the company's assets, liabilities, and shareholders' equity at a specific point in time, in this study, for the last five years. This foundational document serves as a snapshot of the company's financial health and aids in discerning its solvency, liquidity, and overall operational efficiency.

IV.2.3 Cash Flow Statement

Below is the Cash Flow Statement presented by PT VALE Indonesia in thousands of USD over the past five years, spanning from 2018 to 2022. This detailed financial document outlines the company's cash inflows and outflows, delineating the sources and uses of funds throughout the specified period. The meticulous breakdown offered within



this statement encompasses various categories, including operating activities, investing activities, and financing activities.

Table IV. 8 Statement of Cash Flow (in thousands US\$)

Description	2022	2021	2020	2019	2018
Net Cash Flows Provided by Operating Activities	348.158	334.636	292.377	137.994	204.359
Net Cash Flows Used in Investing Activities	- 218.067	- 180.234	- 150.837	- 166.104	- 83.784
Net Cash Flows Used in Financing Activities	- 1.478	- 34.517	- 1.676	- 24.391	- 40.429
Net Increase/(Decrease) in Cash and Cash Equivalents	128.613	119.885	139.864	- 52.501	80.146
Cash and Cash Equivalents at The Beginning of The Year	508.327	388.682	249.035	301.153	221.699
Effect of Exchange Rate Changes on Cash and Cash Equivalents	- 2.898	- 240	- 217	383	- 692
Cash and Cash Equivalents at The End of The Year	634.042	508.327	388.682	249.035	301.153

From the aforementioned table, it can be inferred that despite the decline in the Compound Annual Growth Rate (CAGR) concerning the production and sales volume of PT VALE Indonesia, the company has consistently managed to demonstrate an escalating cash influx year over year. This robust cash generation signifies the resilience and adaptability of the company in navigating through challenging market conditions, possibly attributed to strategic financial management, operational efficiencies, and potentially diversified revenue streams. Despite facing fluctuations in production and sales metrics, the sustained increase in cash reserves portrays a noteworthy aspect of the company's financial health, warranting further investigation into the underlying factors contributing to this positive trend amidst varying performance indicators.

IV.2.4 Financial Ratio

For the internal analysis pertaining to the company's performance, researchers have synthesized the performance through financial ratios. These ratios are derived from historical data and the company's past performance. This comprehensive method involves the utilization of various financial metrics and ratios such as liquidity ratios, profitability ratios, leverage ratios, and efficiency ratios. The historical data serves as a crucial foundation, enabling a comparative analysis over time and facilitating insights into the trends and patterns of the company's financial health and operational efficiency. This rigorous analysis provides a multifaceted view of the company's performance, offering valuable insights for strategic decision-making and future planning within the organization.



Table IV.9 Financial Ratio PT VALE Indonesia dari tahun 2018-2022

Liquidity Ratio					
Description	2022	2021	2020	2019	2018
Current Ratio	5,65	4,97	4,33	4,31	3,60
Cash Ratio	3,62	3,02	2,42	1,82	1,72
Quick Ratio	4,76	4,00	3,43	3,22	2,85
Leverage Ratios					
Description	2022	2021	2020	2019	2018
Debt Ratio	-	-	-	-	0,02
Debt to Equity Ratio	-	-	-	-	0,02
Interest Coverage Ratio	-	-	-	-	37,95
Debt Service Coverage Ratio	-	-	-	-	2,31
Efficiency Ratio					
Description	2022	2021	2020	2019	2018
Asset Turnover Ratio	0,46	0,40	0,34	0,35	0,35
Inventory Turnover Ratio	5,45	4,60	4,38	4,76	5,39
Receivable Turnover Ratio	1,16	1,26	0,72	0,93	0,86
Days Sales in Inventory Ratio	66,98	79,42	83,35	76,71	67,67
Profitability Ratio					
Description	2022	2021	2020	2019	2018
Gross Profit Margin Ratio	26,59%	26,11%	16,26%	14,89%	13,39%
Operating Profit Margin Ratio	23,06%	23,40%	13,58%	11,29%	10,92%
Net Profit Margin	16,99%	17,39%	10,83%	7,34%	7,79%
Return on Assets	7,54%	6,70%	3,58%	2,58%	2,75%
Return on Equity	8,51%	7,70%	4,10%	2,96%	3,21%
Market Value Ratios					
Description	2022	2021	2020	2019	2018
Book Value per Share Ratios	0,2232569	0,2030967	0,5234434	0,4382177	0,6642448
Earnings Per Share	0,0202	0,0167	0,0230	0,0139	0,0230
Price Per Earnings Ratio	23,47	18,70	14,78	17,42	9,45

In terms of performance, the company can be deduced to possess the inherent capacity to exhibit continuous financial growth and evolution over the past five years. The liquidity ratio, indicative of financial health, showcases a robust



and progressive trend, signifying the company's ability to meet short-term obligations efficiently. The leverage ratio has shown improvement, underscored by the absence of both short-term and long-term debts, contributing to a strengthened financial position. The Efficiency Ratio reflects a commendable utilization of asset resources, as depicted by the Assets Turnover Ratio, affirming the company's adeptness in optimizing its assets to generate revenues. The Profitability Ratio exhibits a positive trajectory, evident in the consistent enhancement of the Gross Profit Margin over the past five years, indicative of an improved operational efficiency and profitability.

Furthermore, the Market Value Ratio highlights substantial benefits to shareholders, as evidenced by the substantial and consistent increase in Earnings Per Share (EPS) year after year. This growth in EPS signifies a favorable market perception and solidifies the company's position in delivering value to its shareholders.

IV.3 Cross Section Analysis

In cross-sectional analysis, the valuation used to compare PT VALE Indonesia (INCO) with similar companies operating in the nickel mining sector includes PT Amman Mineral Internasional (AMMN), PT Central Omega Resources (DKFT), and PT Ifishdeco (IFSH). Within this valuation method, calculations involve Liquidity Ratio, Profitability Ratio, Effectivity Ratio, and Market Ratio. The calculations are as follows:

Table IV. 10 Cross Section Analysis

Liquidity Ratio				
Description	INCO	AMMN	DKFT	IFSH
Current Ratio	5,66	3,45	1,09	2,00
Cash Ratio	3,62	1,50	0,35	0,38
Quick Ratio	4,80	3,14	1,00	0,94
Leverage Ratios				
Description	INCO	AMMN	DKFT	IFSH
Debt Ratio	-	0,28	0,33	0,06
Debt to Equity Ratio	-	0,51	1,44	0,12
Interest Coverage Ratio	-	-	1,88	24,92
Debt Service Coverage Ratio	-	0,85	0,14	2,50
Efficiency Ratio				
Description	INCO	AMMN	DKFT	IFSH
Asset Turnover Ratio	0,45	N/A	0,33	0,88
Inventory Turnover Ratio	5,23	N/A	4,42	1,75
Receivable Turnover Ratio	9,04	N/A	9,06	13,35
Days Sales in Inventory Ratio	36,33	31,00	36,72	25,15
Profitability Ratio				
Description	INCO	AMMN	DKFT	IFSH



Gross Profit Margin Ratio	26,55%	57,92%	42,00%	60,00%
Operating Profit Margin Ratio	22,99%	53,99%	14,00%	16,67%
Net Profit Margin	16,96%	38,87%	4,00%	20,00%
Return on Assets	7,52%	16,93%	1,31%	17,14%
Return on Equity	8,49%	30,48%	8,00%	24,00%
Market Value Ratios				
Description	INCO	AMMN	DKFT	IFSH
Book Value per Share Ratios	0,22324	0,04585	- 0,00195	0,01698
Earnings Per Share	0,0201	0,0168	0,0004	0,0057
Price Per Earnings Ratio	23,52	N/A	19,36	11,29

IV.4 Valuation

In order to conduct a comprehensive pro forma analysis, the researcher aims to forecast the sales volume of PT VALE concerning its stakeholders, namely VALE Limited Canada and Sumitomo. The methodology employed in this analysis involves the adjustment of global nickel prices sourced from statista.com with the RMP determined by the Ministry of Energy and Mineral Resources of the Republic of Indonesia. This approach integrates a nuanced understanding of global market dynamics with the specific contractual frameworks within which PT VALE operates, thus enabling a more accurate forecasting of sales volumes. By aligning the global price trends of nickel with the local regulatory environment, the analysis aims to provide a robust projection of PT VALE's sales performance, contributing valuable insights for strategic decision-making and future planning for both the company and its stakeholders.

Table IV. 11 Forecasting PT VALE's nickel production 2023-2030

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Q1	13.827	15.198	17.614	13.080	17.141	17.224	N/A	N/A	N/A	N/A	N/A
Q2	12.567	15.048	18.701	17.631	18.893	20.107	N/A	N/A	N/A	N/A	N/A
Q3	17.513	18.127	19.477	19.820	18.193	20.163	N/A	N/A	N/A	N/A	N/A
Q4	16.183	17.015	16.445	20.494	20.579	19.313	N/A	N/A	N/A	N/A	N/A
Total	60.090	65.388	72.237	71.025	74.806	76.807	77.581	81.177	78.726	75.802	70.717

Table IV. 12 Forecasting PT VALE's nickel sales volume 2023-2030

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Q1	13.486	14.847	16.713	13.867	17.239	17.524	N/A	N/A	N/A	N/A	N/A
Q2	13.527	15.845	19.887	16.966	18.764	19.620	N/A	N/A	N/A	N/A	N/A
Q3	17.334	18.571	19.954	19.999	18.566	20.580	N/A	N/A	N/A	N/A	N/A
Q4	16.613	17.352	16.291	21.211	21.062	19.919	N/A	N/A	N/A	N/A	N/A
Total	60.960	66.615	72.845	72.043	75.631	77.643	78.976	82.907	79.477	77.198	71.379



The consistent decline in production rates, as evidenced by the Compound Annual Growth Rate (CAGR) of -1.79%, draws attention to a troubling trend observed over the specified period. Interestingly, the similarity between the CAGR of -1.74% and the company's nickel production suggests a closely mirrored pattern. While this might raise initial concerns, it also introduces an aspect worth exploring further and contemplating in depths.

IV.5 Pro-Forma Analysis

In the realm of pro forma analysis, researchers undertake the intricate task of forecasting a company's performance based on historical data. This analytical endeavor is underpinned by a series of assumptions meticulously crafted to facilitate the pro forma analysis. Leveraging previously analyzed data becomes integral to this forecasting exercise, encompassing critical elements such as the Compound Annual Growth Rate (CAGR) of nickel production and company sales, financial statements based on previously calculated ratios, and presumptions regarding anticipated world nickel prices. Drawing insights from the average of historical data trends, researchers embark on constructing pro forma projections for both the Balance Sheet and Income Statement, offering a glimpse into the projected performance landscape.

Additional assumptions come into play when conducting the pro forma analysis, notably concerning the discounted free cash flow. These assumptions encompass scenarios devoid of force majeure, the absence of fixed asset sales, and a fixed corporate tax rate set at 22%. Researchers delve into forecasting financial ratios, utilizing this comprehensive analytical model to juxtapose the forecasted outcomes against historical data, thereby facilitating a rigorous comparative analysis.

The integration of these assumptions and methodologies into the pro forma analysis not only shapes the forecasted projections but also augments the predictive capability of the model. This holistic approach allows for a more nuanced understanding of the company's projected performance trajectory, enabling stakeholders to glean insights into potential future outcomes and evaluate the company's financial robustness in light of varying scenarios and assumptions. The meticulous comparison between forecasted and historical data forms the bedrock for gauging the model's accuracy and reliability, offering valuable insights into the company's anticipated financial landscape.

Table IV. 13 Proforma Analysis for PT VALE Indonesia from 2023-2030

Liquidity Ratio								
Descripti on	2023	2024	2025	2026	2027	2028	2029	2030
Current Ratio	4,51	4,55	4,52	4,53	4,53	4,53	4,53	4,53
Cash Ratio	2,43	2,46	2,44	2,44	2,45	2,44	2,45	2,45
Quick Ratio	3,59	3,62	3,60	3,60	3,61	3,60	3,61	3,86
Leverage Ratios								
Descripti on	2023	2024	2025	2026	2027	2028	2029	2030
Debt Ratio	-	-	-	-	-	-	-	-
Debt to Equity Ratio	-	-	-	-	-	-	-	-



Interest Coverage Ratio	-	-	-	-	-	-	-	-
Debt Service Coverage Ratio	-	-	-	-	-	-	-	-
Efficiency Ratio								
Description	2023	2024	2025	2026	2027	2028	2029	2030
Asset Turnover Ratio	0,35	0,34	0,33	0,33	0,32	0,32	0,31	0,54
Inventory Turnover Ratio	- 4,01	- 3,94	- 3,98	- 4,04	- 4,05	- 4,09	- 4,13	- 5,58
Receivable Turnover Ratio	0,91	0,92	0,92	0,93	0,94	0,95	0,96	0,94
Days Sales in Inventory Ratio	- 91,05	- 92,69	- 91,64	- 90,28	- 90,02	- 89,13	- 88,30	- 65,37
Profitability Ratio								
Description	2023	2024	2025	2026	2027	2028	2029	2030
Gross Profit Margin Ratio	22,99%	25,23%	24,93%	24,38%	24,85%	24,72%	24,65%	24,74%
Operating Profit Margin Ratio	20,07%	22,20%	21,89%	21,39%	21,83%	21,70%	21,64%	21,72%
Net Profit Margin	15,66%	17,32%	17,07%	16,68%	17,02%	16,93%	16,88%	16,94%
Return on Assets	6,22%	6,61%	6,29%	5,95%	5,91%	5,72%	5,55%	5,43%
Return on Equity	6,94%	7,25%	6,81%	6,39%	6,32%	6,11%	5,92%	5,78%
Market Value Ratios								
Description	2023	2024	2025	2026	2027	2028	2029	2030
Book Value per 1	0,31283707	0,40198181	0,50232458	0,61335726	0,72809680	0,8488661	0,9868198	1,09713772
	1	8	1	2	2	9	7	7



Share Ratios								
Earnings Per Share	0,0227	0,0301	0,0351	0,0400	0,0469	0,0527	0,0584	0,0642
Price Per Earnings Ratio	20,89	20,89	20,89	20,89	20,89	20,89	20,89	20,89

From the analysis table, it is evident that there has been a decline in the Liquidity Ratio due to the substantial acquisition of Fixed Assets by the company during the period. This strategic move was undertaken to attain the targeted revenue for that specific period. Moreover, this action is deemed crucial to ensure that the cash reserves held by the company can be optimally utilized as a resource.

In the context of this research, the assumption posited by the researcher is that capital expenditures are entirely financed using the company's internal resources without external financing from entities such as banks. Consequently, the Leverage Ratio remains at a constant null value. Meanwhile, concerning the Profitability Ratio, despite the anticipated upward trend in global nickel prices over time, the Compound Annual Growth Rate (CAGR) for production and sales shows a declining trend. Therefore, the company must consistently strive to maximize efficiency in resource utilization to support its operational interests.

In assessing the Market Value Ratio, assuming the absence of stock splits or an increase in outstanding shares, there has been a consistent decline in the Price-to-Earnings Ratio year by year. This downward trend could potentially influence shareholders' sentiments regarding stock prices and the perceived value of the company.

Table IV. 14 Calculation of Weighted Average Cost of Capital

Cost of Equity	
Risk free rate	0,000%
Beta	1,07
Return of markets	10,31%
Cost of Equity (Ke)	11,037%
Calculation of return of market	
Start date	1.445,00
Valuation date	7.125
Years	17,25
CAGR	10,31%
Calculation of market value weights	
Shares outstanding	9.936
Price per share	0,473



Value of equity shares 4.703

Value of debt -

WACC	
Kd	0,000%
Ke	11,037%
Wd	0,00%
We	100,00%
WACC	11,04%

In this case, PT VALE Indonesia doesn't possess any long-term debt, so its Weighted Average Cost of Capital (WACC) simplifies to equate solely to the cost of equity. This outcome stems from the WACC formula, wherein, under this scenario, the debt component becomes negligible, standing at 0.00%. Consequently, the WACC calculation effectively reduces to the equity component, aligning with the principles of the capital asset pricing model.

The author also conducted an analysis of the cost of equity. The methodology employed for this assessment was the Capital Asset Pricing Model (CAPM). The risk-free rate was obtained from the KSEI website using Government Bond Yields, while the Market Risk and Equity Risk were derived from Damodaran's research. Through these calculations, the researcher was able to compute the Weighted Average Cost of Capital (WACC). This WACC serves as a pivotal metric in discounting the free cash flows projected for the company until the year 2030. Subsequently, from these calculations, the Free Cash Flow was determined as follows:

Period	0	1	2	3	4	5	6	7	8
in Thousand USD	2023	2024	2025	2026	2027	2028	2029	2030	
EBIT	288.710	383.718	447.751	510.071	597.504	671.290	744.394	817.652	
Less: taxes	-	-	-	-	-	-	-	-	-
NOPAT	225.193	299.300	349.246	397.855	466.053	523.606	580.627	637.768	
Add: Depreciation and amortization	212.127	254.891	301.713	351.735	403.754	456.240	507.382	555.174	
Add/Less: Working capital changes	146.634	190.366	206.598	230.659	233.054	235.973	232.170	215.009	
Less: Investment in fixed assets	-	-	-	-	-	-	-	1.002.17	1.017.56
FCFF	714.595	668.627	754.714	835.698	907.042	964.038	8	5	
Discount factor	-	-	-	-	-	-	-	-	-
Present Value of FCFF	130.640	75.929	102.842	144.551	195.820	251.781	318.001	390.386	
	0,90	0,81	0,73	0,66	0,59	0,53	0,48	0,43	
	117.655,	61.585,3	75.123,1	95.094,7	116.017,	134.346,	152.814,	168.952,	
	27	9	1	0	87	42	40	48	



After getting the Present Value from the Free Cash Flow above, the results are calculated by looking for the Terminal Value (TV). The known TV is then used to calculate the Value of Equity. After the value of equity is found, the Intrinsic Value per Share can be calculated.

Table IV. 15 Discounted Cash Flow Calculation

NPV	686.279
Terminal Value	4.702.590
PV Terminal Value	2.035.200
Total Value	2.721.479
Total Debt	0
Enterprise Value	4.702.590
	9.936
Total Shares	Mil.
Intrinsic Value Per Share	0,40151
Intrinsic Value Per Share (IDR)	6.022,66

In this calculation, it is known that the Intrinsic Value Per Share in Indonesian Rupiah is IDR 6,022, while the share price at closing on 12/30/2022 is IDR 7,100, which means that at that time the price was undervalued.

IV.6 Multiples Model

The Market Multiple Model is a comprehensive analytical tool that evaluates companies within an industry by comparing various financial metrics, allowing for a comprehensive assessment of their relative market positions and performance. Through this comparative analysis, researchers aim to glean insights into PT VALE Indonesia's standing vis-à-vis its competitors, shedding light on its market valuation, financial health, and competitive positioning within the nickel mining sector.

In order to conduct an analysis of market behavior within the nickel mining sector, researchers need to employ the Market Multiple Model. This analysis aims to scrutinize how PT VALE Indonesia compares with its competitors in the same industry. The Market Multiple Model will juxtapose PT VALE Indonesia (INCO) alongside PT Amman Mineral International (AMMN), Central Omega Resource (DKFT), and PT Ifishdeco (IFSH). These four companies operate within the same sector of nickel mining. The market data will be assessed utilizing various metrics, including EV/Sales, EV/EBITDA, EV/EBIT, and Price to Earnings Ratio (P/E). The computed results are as follows:

Table IV. 16 Valuation and Comparison for Other Company in the same Industry

In Million USD at 31 Dec 2022		Market Data		Financial Data				Valuation		
Company symbol	Price	Market Cap	TEV	Sales	EBITDA	EBIT	Earnings	EV/Sales	EV/EBITDA	P/E
INCO	0,475	4.721,500	4.087,500	1.179	279	279	200	3,47	14,65	0,00238
AMMN	0,116	7.630,303	22.283,303	2.830	1.550	1.550	1.093	7,87	14,38	0,00011



DKFT	0,007	39,104	804,104	777	219	124	58	1,03	3,67	0,00012
IFSH	0,064	135,680	226,680	939	273	249	191	0,24	0,83	0,00034
Average								3,154	8,382	0,001

Based on the calculations derived from the Multiple Market Approach, it has been determined that the EV/EBITDA Multiple stands at 8.382. Consequently, the valuation of PT VALE Indonesia is established through the utilization of the Multiple Market Approach as follows:

Table IV. 17 Multiple Market Method

EV/EBITDA Multiple	8,382
Projected EBITDA 2023	\$ 279.000.000
Enterprise Value	\$ 2.338.640.761
Total Debt	\$ -
Cash and Equivalent	\$ 2.382.859.239
Market Capital (In Million)	\$ 4.721.500.000
Outstanding Share	9.940.000.000

The EV/EBITDA Multiple, a critical financial metric obtained from this approach, signifies the relationship between the enterprise value (EV) and earnings before interest, taxes, depreciation, and amortization (EBITDA). This multiple serves as a key indicator in the valuation process, providing insights into the company's financial performance and market positioning.

IV.7 Sensitivity Analysis

Sensitivity analysis will illustrate which variables have the most impact on the Present Value of Free Cash Flow of PT VALE Indonesia. The variables under examination are those related to forecasted Net Income, including Sales, Operating Expenses, Nickel Price, and COGS. Sensitivity testing is conducted using a 20% increase or decrease in these variables. Below are the calculated outcomes if these four variables experience either an increase or decrease.

Table IV. Sensitivity Analysis Calculations

Variable	NPV	Variable +20%	Changes	Variable -20%	Changes
Sales	686.279	1.844.235	1.157.955	- 471.677	- 1.157.956
Operating Expense	686.279	608.013	- 78.266	764.545	78.266
Price	686.279	1.844.235	1.157.956	- 471.677	- 1.157.956
COGS	686.279	- 751.823	- 1.438.102	2.124.382	1.438.102



The numerical computations will be depicted in chart format by the author, facilitating the visualization of the variables' respective impacts in cases of either escalation or decline within those variables. This graphical representation aims to elucidate the variables that exert the most significant influence when experiencing fluctuations, thereby enhancing the comprehension of their relative impacts.

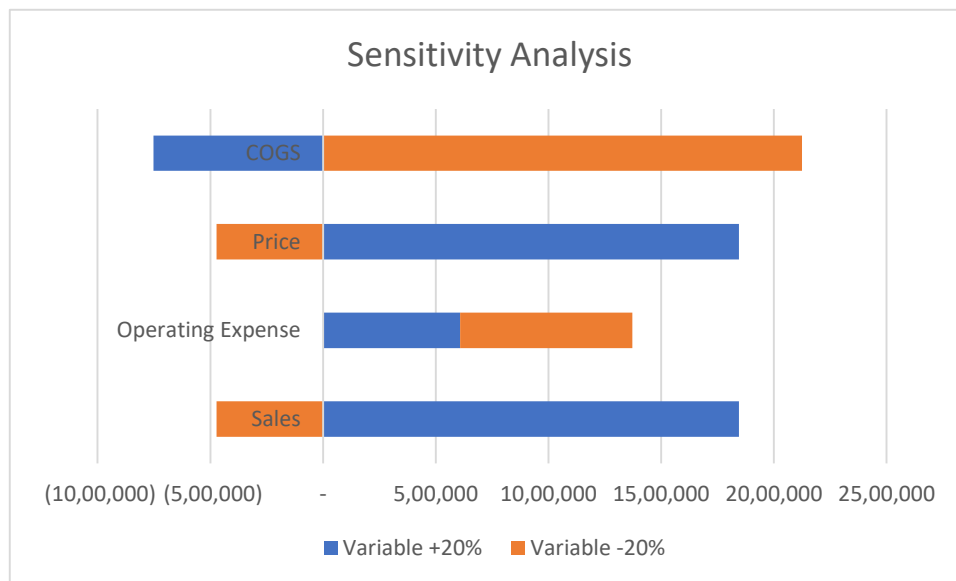


Figure 4.1 Sensitivity Analysis Result Chart

In the figure above, it can be inferred that the most influential factor in increasing a company's PV Cash Flow is the fluctuation in COGS (Cost of Goods Sold). If COGS experiences a 20% increase, then FCF (Free Cash Flow) will decrease significantly compared to the other four variables. Similarly, if COGS decreases by 20%, the company will experience the greatest gain compared to the other four variables. The second and third rankings are equivalent, namely Nickel Price and Sales, as both are interconnected with sales volume.

IV.8 Business Solution

Given the declining trend in both nickel production and sales volume's Compound Annual Growth Rate (CAGR), PT Vale Indonesia necessitates a particular focus on its operational facets. Despite the projected upward trajectory of nickel prices due to the increasing global consumption trend, the company requires strategic initiatives to preempt any downturns to ensure business sustainability. Presently, approximately 70% of nickel derivative products serve as raw materials for stainless steel, 11% for batteries, 7% for alloy material, and the remaining portion is utilized across various industries such as anti-corrosion coatings, catalysts, magnets, pigments, and diverse applications.

Based on previous valuation calculations, the acquisition of fixed assets could be allocated towards acquiring new technology for processing ferronickel into stainless steel and refining nickel matte into pure nickel, nickel board alloy, plating, Nickel Sulphate, or Cobalt Sulphate. This strategic move could propel the company towards sustainability while aiming to capitalize on further nickel processing. Furthermore, notwithstanding the company's positive Free Cash Flow, it is recommended that the company strategically engages in capital expenditure by leveraging external sources like banks. This strategic engagement is due to the resourcefulness of the company's cash, which could serve as a valuable resource in unforeseen circumstances.

IV.10 Implementation Plan and Justifications

PT VALE Indonesia can strategically prepare a series of preventive measures to address the projected negative implications analyzed by the researchers. The comprehensive downstream processing could potentially lead to a reduction in natural



resource exploitation, consequently fostering sustainability initiatives. Conducting research to expedite downstream processing and tackle environmental issues emerges as a viable course of action. A proven hydrometallurgical technology, namely High-Pressure Acid Leach (HPAL), presents an innovative solution for generating materials required for electric vehicle batteries. This technology excels in nickel and cobalt extraction, minimizes energy consumption, and boasts environmentally friendly attributes.

Within this context, there exist several plausible implementation plans that PT VALE Indonesia can adopt. These plans encompass a series of strategic steps aimed at integrating the technology effectively:

- 1) Companies can conduct research both internally and externally for market research and operational efficiency. This research can be initiated by PT VALE Indonesia's management and might necessitate specific expenditures within the company's Research and Development (R&D) department. Undertaking such initiatives aligns with the strategic goals of PT VALE Indonesia, aiming to glean insights into market dynamics and enhance operational efficiency by leveraging internal and external research endeavors. These investments in R&D are fundamental for staying abreast of industry trends, improving products or services, and optimizing internal processes, hence warranting the allocation of resources and finances.
- 2) Introducing technology to process nickel into semi-finished or finished products entails substantial investment and requires readiness from the company's Human Resources to operate this new technology. The author has conducted projections to ensure that these investments do not pose inherent risks to the company. This strategic move involves considerable capital investment, reflecting PT VALE Indonesia's commitment to technological advancement and operational efficiency. Moreover, preparing the workforce to handle this technology is vital for seamless integration and effective utilization, ensuring the company's readiness for the adoption of advanced processes. By mitigating risks through detailed projections, PT VALE Indonesia can undertake these investments in technology with a more calculated approach, aiming to enhance its competitive edge in the industry and drive sustainable growth.

V. CONCLUSION AND RECOMMENDATION

V.1 Conclusion

In recent years, the nickel market has witnessed a noteworthy surge in both price and demand, signaling a significant shift in the dynamics of this vital industrial metal. The upward trajectory of nickel prices has not only captured attention but also sparked strategic considerations within the industry. Concurrently, the escalating demand for nickel, coupled with its concurrent price surge, underscores a critical juncture in the market, prompting companies to reassess their downstream directives and production strategies.

As the price of nickel ascends, the heightened demand for this essential commodity becomes increasingly palpable, prompting a reevaluation of downstream directives within the industry. Companies, including PT VALE Indonesia, have encountered a scenario where their nickel production is predominantly sold, nearly exhausting the company's nickel reserves. This realization has engendered a crucial strategic pivot towards further refining nickel ore, emphasizing a more intricate processing approach to maximize economic benefits.

This inclination towards enhancing downstream processes aligns with a broader economic aim, focusing on capitalizing on the intrinsic value of nickel reserves. The intent behind refining nickel ore to a greater extent is anchored in leveraging these resources more effectively and efficiently. This strategic pivot entails transforming nickel ore into semi-finished or finished products, augmenting its value and optimizing its economic potential within the global market.

Amidst these market dynamics, the confluence of rising nickel prices, escalating demand, and strategic directives towards downstream refinement beckons a profound paradigm shift in the nickel industry. Companies, including PT VALE Indonesia, are strategically poised to leverage these market trends, recalibrating their operational strategies and refining processes to capitalize on the burgeoning economic opportunities inherent in the evolving nickel landscape.

Businesses may invest in advanced technologies for future economic gains. Currently, several smelters in Indonesia are transitioning towards operationalizing High-Pressure Acid Leaching (HPAL) technology, with some still in the construction phase. The primary products derived from this process include Mixed Hydroxide Precipitate (MHP) and Mixed Sulphide Precipitate (MSP). These materials serve as crucial components in lithium battery production, reflecting the growing



importance of advanced smelting processes in catering to the burgeoning demand for lithium-ion batteries, particularly in the context of the expanding electric vehicle market worldwide. The strategic adoption of such advanced technologies not only anticipates economic benefits for companies but also aligns with global trends toward sustainable energy solutions.

V.2 Recommendation

The author has conducted a comprehensive analysis of the company's past performance while also forecasting its future trajectory. Through this analytical process, the author has arrived at a conclusion that, despite the prevailing upward trend in nickel prices, the company's performance has consistently exhibited a declining trend. However, this trend poses a significant risk as nickel prices are influenced by global supply and demand dynamics. Consequently, there exist strategic and preventive measures that the company can consider implementing to address these challenges. These measures encompass several key aspects, such as:

- 1) **Diversification Strategies:** Exploring avenues to diversify the company's product portfolio or venturing into related industries presents a strategic approach to mitigate potential risks linked to the volatility of nickel prices. One plausible strategy involves channeling investments into technological advancements, sourced externally, to facilitate the transformation of raw materials into a spectrum of refined products. These products may encompass pure nickel, stainless steel, nickel-based alloys, nickel plating, and various other derivatives. Such diversification not only broadens the company's product range but also reduces reliance solely on nickel prices, thereby enhancing resilience against market fluctuations. By leveraging external funding sources to finance technological advancements and product diversification, the company can fortify its competitive edge and navigate through market uncertainties more effectively.
- 2) **Operational Efficiency Enhancement:** Over the years, the company has consistently elevated its efficiency levels, fostering a continuous improvement trajectory. This persistent focus on enhancing efficiency has notably enabled the company to uphold its gross margin stability, akin to preceding periods. The proactive steps taken by the company to streamline its operations, amplify productivity, and curtail costs have not only fortified its operational framework but also positioned it to weather market uncertainties more robustly. By implementing measures geared towards operational optimization, the company fortifies its capacity to navigate through unpredictable market fluctuations while sustaining its competitive edge. This commitment to efficiency enhancement underscores the company's strategic resilience and its ability to maintain a steady financial performance despite evolving market conditions.
- 3) **Risk Management Protocols:** Developing robust risk management strategies tailored to navigate the volatility of nickel prices and their impact on the company's revenue streams.
- 4) **Market and Demand Analysis:** Undertaking comprehensive market analyses and forecasting demand patterns plays a pivotal role in strategic decision-making within the nickel industry. By meticulously examining market dynamics, trends, and consumer behavior, companies can proactively anticipate shifts in the demand for nickel and subsequently fine-tune their production strategies. This proactive approach ensures an agile response to market fluctuations, enabling companies to optimize their production levels in alignment with the evolving demand patterns. Through astute market analysis and demand forecasting, companies can attain a competitive edge by adjusting production strategies to meet market demands effectively. This practice not only enhances operational efficiency but also bolsters the company's capacity to cater to fluctuating market needs, ultimately fostering sustained growth and market leadership.
- 5) **Investment in Research and Development in nickel refining process:** Investing in research and development initiatives to explore alternative materials or innovative production methods to reduce dependency on nickel prices.
- 6) **Strategic Partnerships:** In navigating market uncertainties and mitigating operational risks, one strategic approach involves the exploration of collaborations or partnerships within the industry. This initiative aims to foster alliances that can effectively share risks and leverage synergies. The constrained customer base, limited to VLC and Sumitomo, exposes the company to significant operational risks due to dependence on these key partners. Establishing strategic collaborations or partnerships within the industry could potentially broaden the customer base,



diversify market exposure, and consequently reduce the company's susceptibility to operational uncertainties stemming from reliance on a limited customer pool. This strategic maneuver not only mitigates risks but also unlocks opportunities for diversification, innovation, and enhanced resilience in managing market fluctuations.

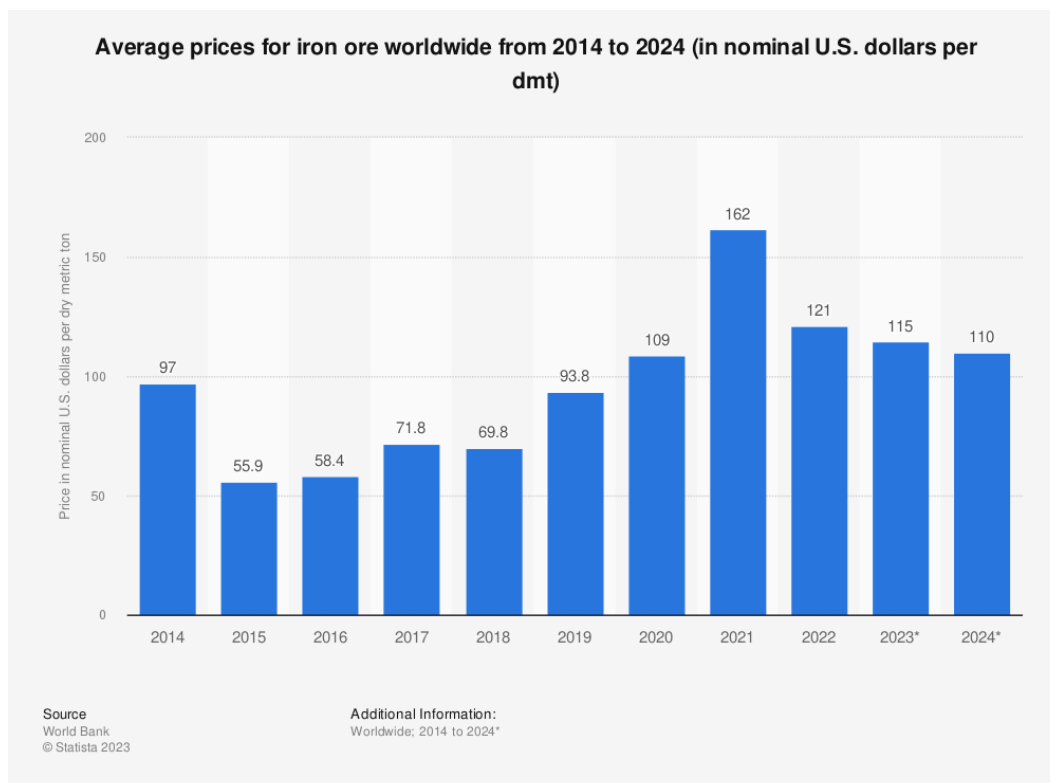
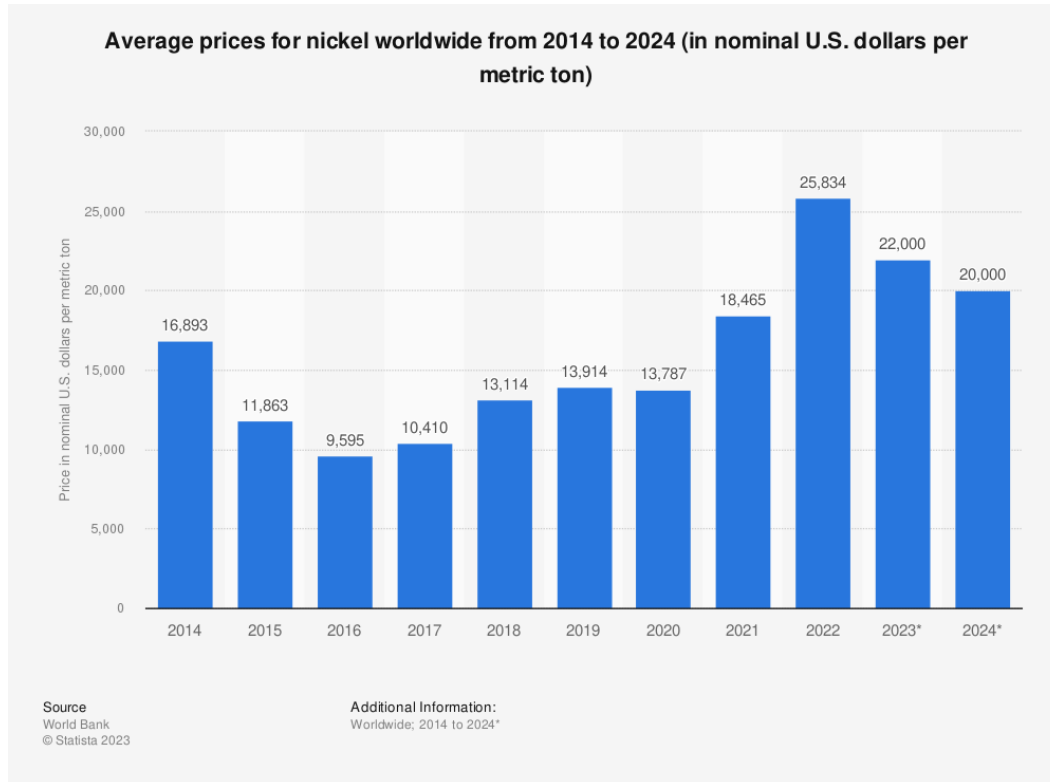
The implementation of these strategic and preventive steps could potentially mitigate the adverse effects of fluctuating nickel prices, ensuring a more resilient and adaptable position for the company in the face of dynamic market conditions.

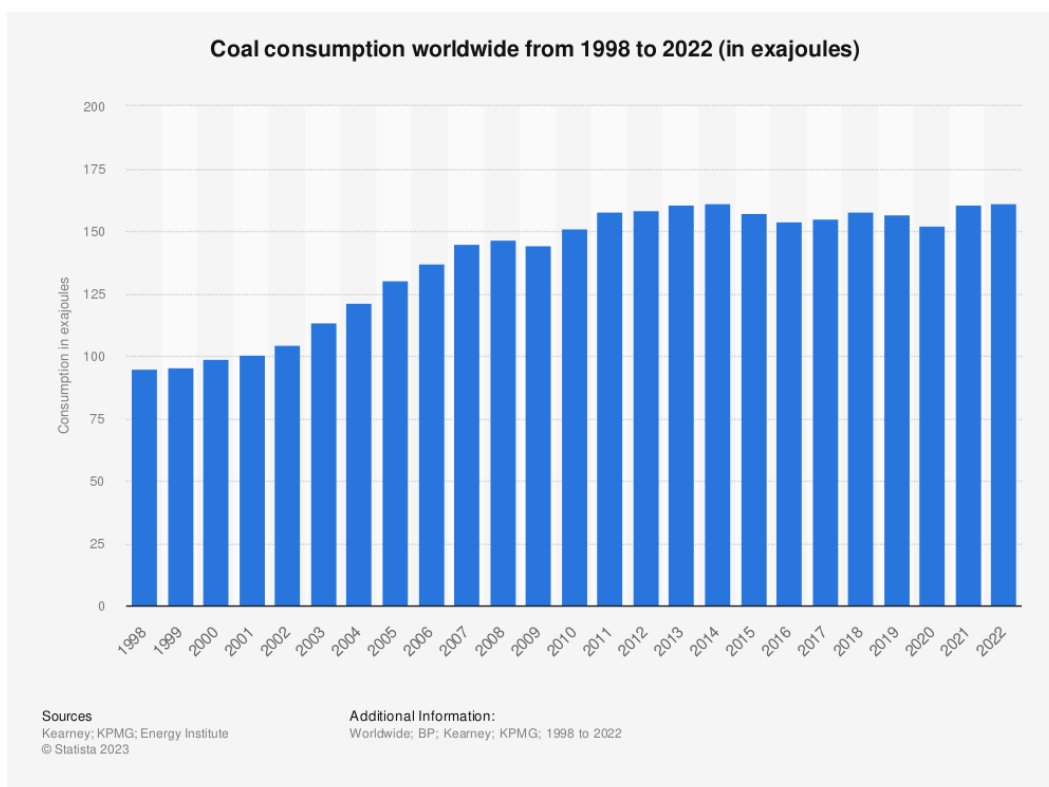
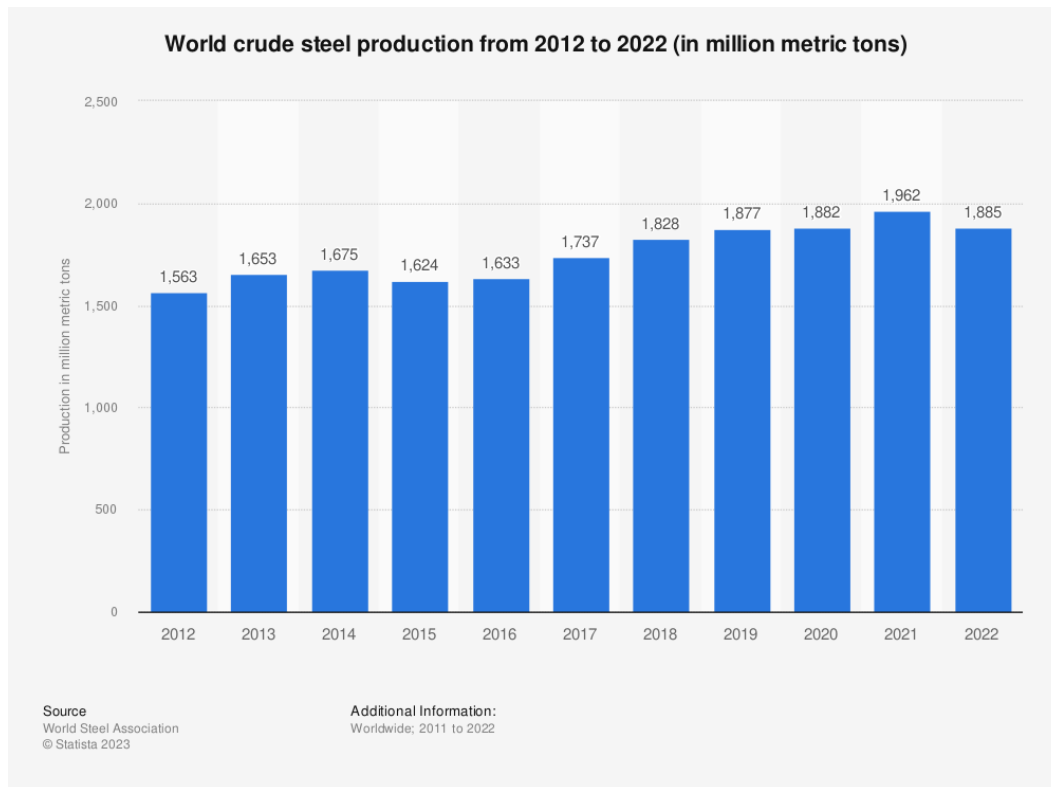
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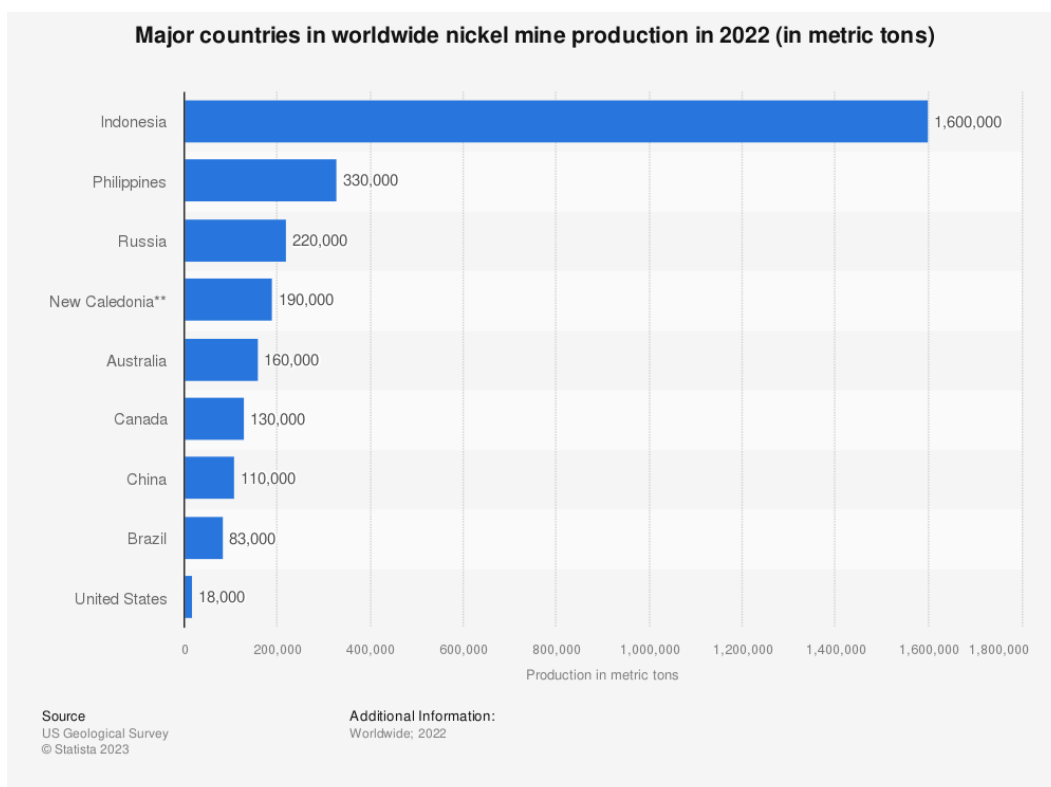
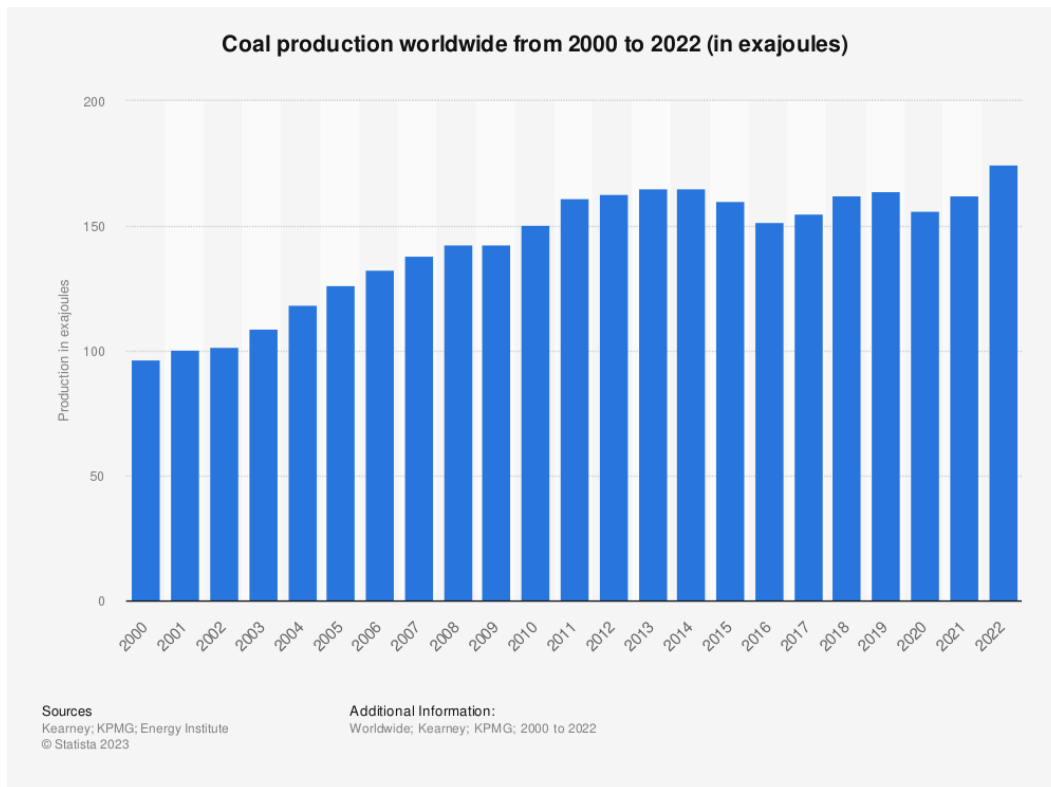
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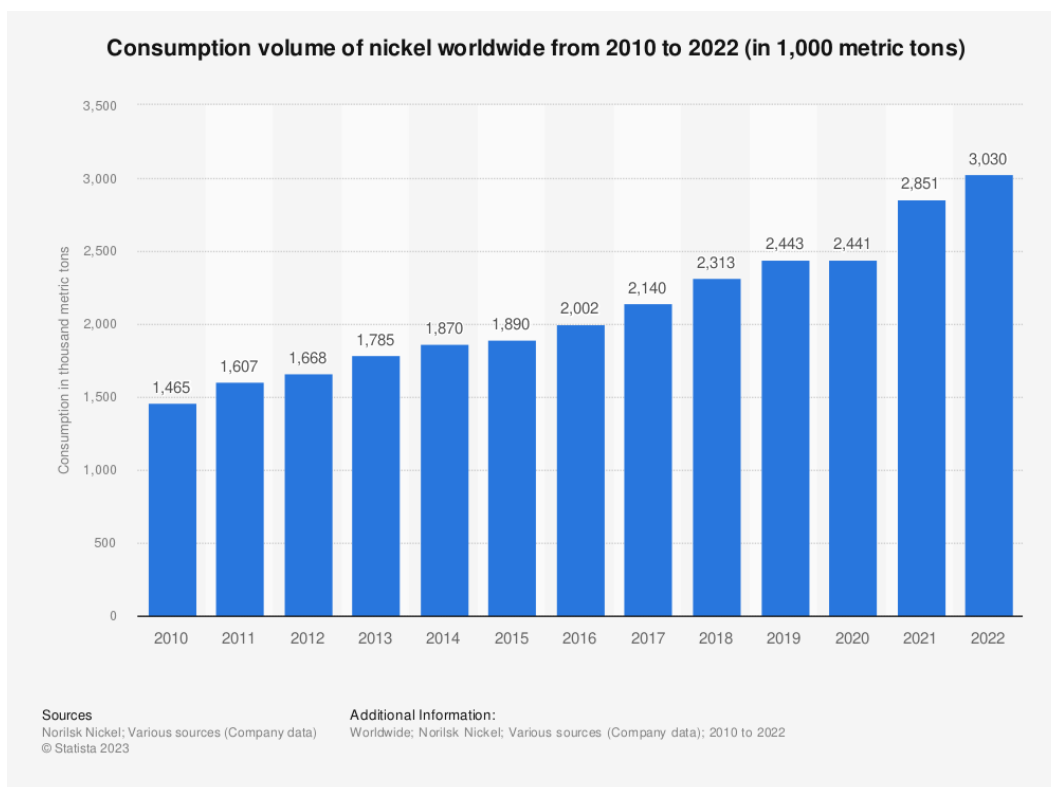
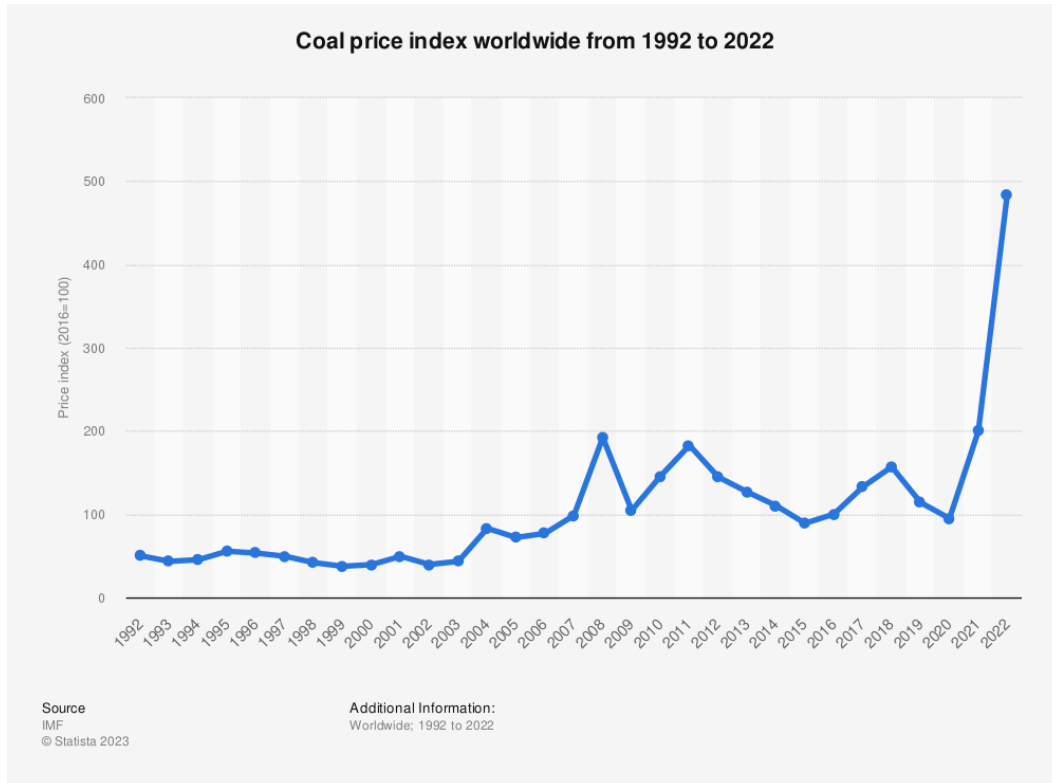


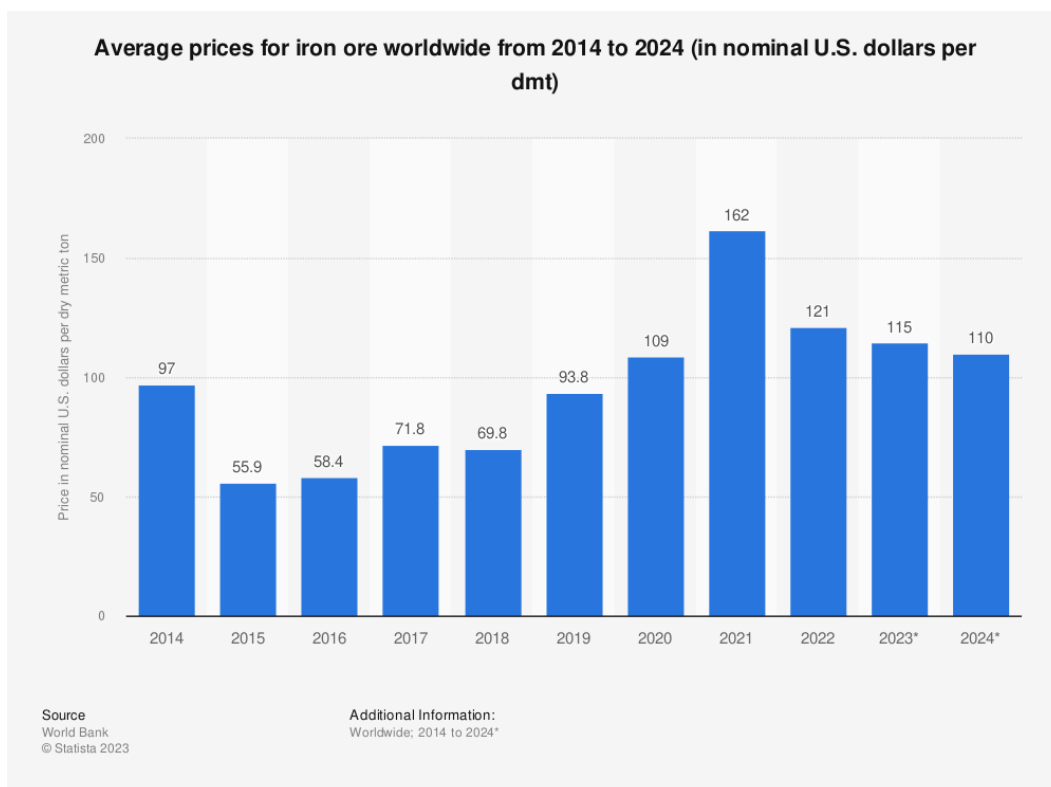
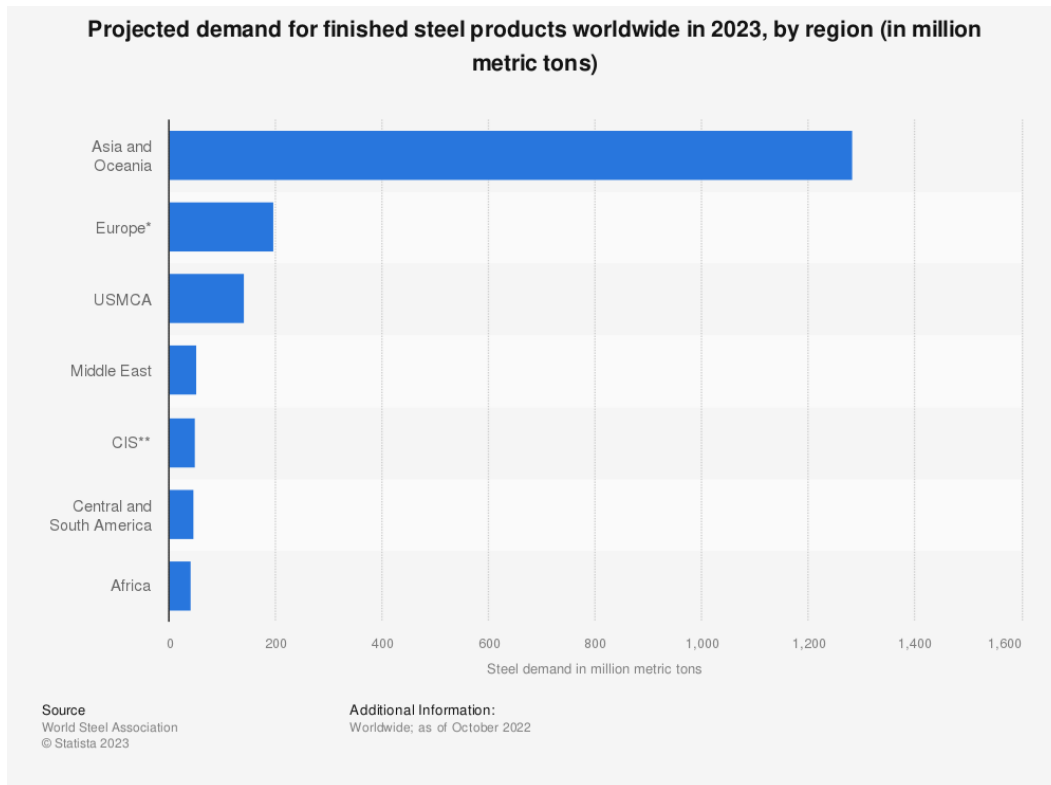
APPENDICES

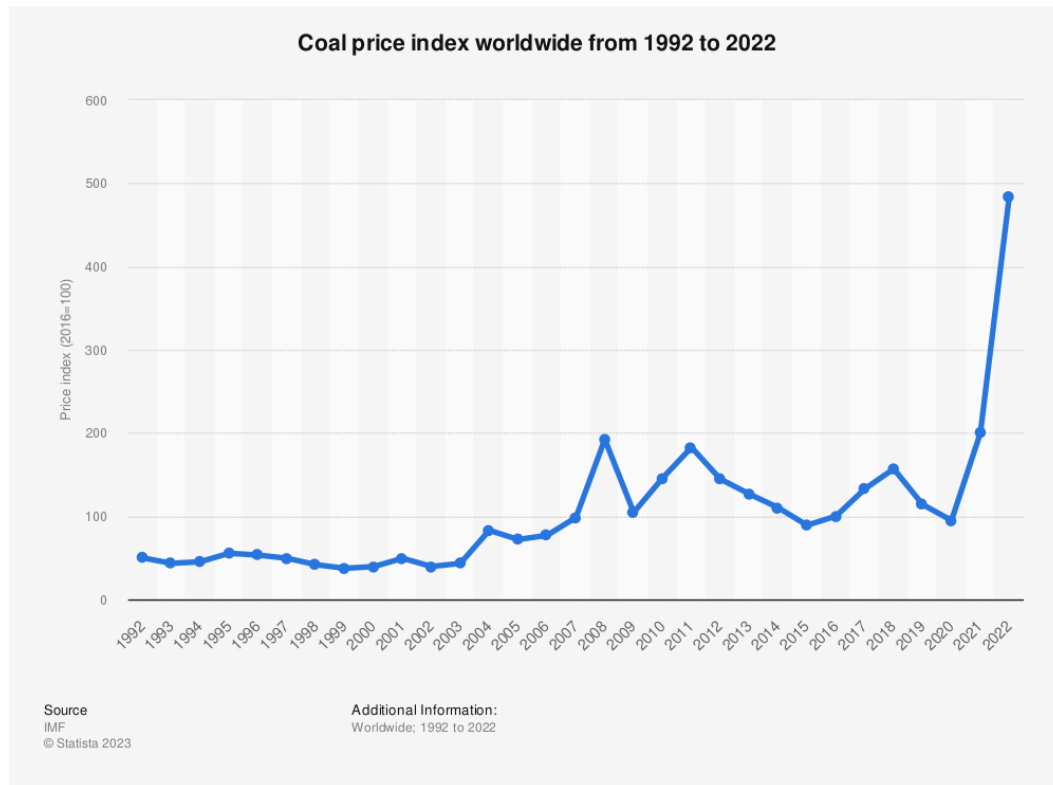












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