

The Role of Nickel Downstreaming in Advancing Green Economy Transformation and Foreign Direct Investment in Indonesia

M.Nashrullah^{✉1}, Frida Eka Ristanti², Resty Abdillah Paryanda³, Restu Asa Marisza Sukma⁴, Rokhmat Subagiyo⁵, Muhammad Aswad⁶

^{1,2,3,4,5,6} Sharia Economics, Postgraduate UIN Sayyid Ali Rahmatullah Tulungagung

Abstract

This study analyzes the transformation of Foreign Direct Investment in the nickel downstream sector in Indonesia within the framework of a green economy. This research aims to fill the gap in the literature regarding the integration between downstream policies, foreign investment patterns, and environmental sustainability principles. Using a structured literature study approach with thematic analysis techniques, this study synthesizes secondary data from accredited journal articles, government reports, and related institution publications between 2015 and 2025. The results of the study show that downstream policies have succeeded in changing the character of FDI from resource extraction-oriented to value-added industry-based strategic investments, especially in the electric vehicle supply chain. However, this transformation faces an ecological paradox, where the nickel production process still relies on fossil energy. Therefore, the success of nickel downstream must be assessed based on the quality of green technology transfer and the application of Environmental, Social, and Governance (ESG) principles to ensure a truly sustainable modernization of the industry.

Keywords: *Foreign Direct Investment, Green Economy, Nickel downstreaming*

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✉ Corresponding author :

Email Address : fridaeka64@gmail.com

INTRODUCTION

The global transition to a low-carbon economy has brought significant changes to the direction of industrial development and international investment patterns. The increasing need for clean energy technology, especially electric vehicles, has made critical minerals a strategic component in the global supply chain. Nickel is one of the main minerals due to its role as an important raw material in the production of electric vehicle batteries, thus creating opportunities for countries with large mineral reserves to increase industrial competitiveness through value-added enhancement strategies (Sovacool et al., 2020). In this context, Indonesia, as one of the countries with the largest nickel reserves in the world, implements a nickel downstream policy as an effort to change the economic structure from dependence on raw material exports to value-added industrial development.

Indonesia's nickel downstream policy reflects a paradigm shift in natural resource management. Prior to the implementation of this policy, Indonesia's mining sector was still heavily dependent on primary commodity exports so that the economic benefits obtained

were relatively limited, especially in terms of technology mastery, domestic industrial development, and increasing position in the global value chain (I. R. Putri, 2025). Through the policy of restricting the export of raw nickel ore and the obligation to process minerals domestically, the government seeks to strengthen national industrialization by attracting foreign direct investment (FDI) in the mineral processing sector, smelter construction, battery industry, and electric vehicle ecosystem. Empirical studies show that natural resource-based industrialization strategies can provide greater economic benefits if they are able to create industrial linkages, increase technological capacity, and develop value-added production activities (Aulya & Yasin, 2025)

The implementation of nickel downstream policies has changed Indonesia's *Foreign Direct Investment* (FDI) pattern from resource-extraction-based investment to value-added industrial investment. After the government implemented a ban on nickel ore exports in 2020, there was a significant increase in foreign investment in the mineral processing sector, especially the base metal industry and the construction of smelter facilities. Data from the Ministry of Investment/BKPM shows that Indonesia's FDI realization increased from the period before downstreaming to USD 45.6 billion in 2022 or grew by around 47% compared to the previous year, with the base metal industry being one of the main sectors receiving investment (BPKM, 2023) The trend continued in 2024 when FDI realization reached USD 55.3 billion, an increase of 21% year-on-year, mainly driven by the expansion of investment in the mining and metal refining sectors after the nickel export ban policy was implemented (BPKM, 2025)

The growth in investment shows a change in the character of FDI in the Indonesian nickel industry. Foreign investors are no longer only oriented towards access to natural resources (resource-seeking investment), but have begun to build domestic production facilities through investment in smelters, the base metals industry, and the electric vehicle ecosystem. By 2025, the base metals industry sector will even be the largest recipient of FDI with a value of around USD 14.6 billion, showing the growing link between downstream policies and the transformation of foreign investment into value-added industries.

Foreign Direct Investment (FDI) has an important role in supporting industrial transformation because it not only provides capital, but can also encourage technology transfer, increased productivity, and the integration of domestic industries into global production networks. Several previous studies have shown that FDI can have a positive impact on improving industrial capabilities if the investment is accompanied by the process of technology transfer and strengthening the capacity of local companies (Mara et al., 2025) In the context of Indonesia's nickel industry, the increase in foreign investment after the implementation of downstream policies shows a change in investment character from the previous oriented resource exploitation (resource-seeking investment) to strategic investment based on industrial development. However, the success of the transformation does not only depend on the amount of investment value, but also on the quality of the investment that comes in, especially in the aspects of technological innovation and environmental sustainability.

As the sustainable development agenda develops, nickel downstream is also increasingly closely related to the concept of the green economy. The concept of green economy emphasizes that economic growth must go hand in hand with reducing environmental risks, improving resource efficiency, and applying sustainability principles (Hutagalung & Geganesywarara, 2025) Although nickel has an important contribution in supporting low-carbon technology, its extraction and processing process still faces various environmental challenges, such as high energy consumption, increased carbon emissions, changes in land use, and pressure on the ecosystem around mining and industrial areas (Sovacool et al., 2020). This creates a paradox that minerals used to support the global energy transition can still produce ecological impacts if the production process does not apply sustainability principles.

Various previous studies have discussed nickel downstreaming from several perspectives. (A. T. Sutrisno et al., 2021) explain Indonesia's mineral resources policy through a resource nationalism approach and changes in mining sector governance. (Lahadalia et al., 2024) shows that nickel downstreaming is an industrial policy strategy that plays a role in building an electric vehicle ecosystem and strengthening Indonesia's position in the regional supply chain. Meanwhile, other research discusses the relationship between FDI, economic growth, and industrial capacity building by emphasizing the impact of investment on national economic development (A. Sutrisno, 2022)

However, existing research still shows limitations. Most previous research has tended to address nickel downstreaming from an economic perspective, increased investment, or industrial policy separately. Research on the relationship between nickel downstreaming, the transformation of foreign direct investment patterns, and green economy principles has not been widely analyzed in an integrated manner. In addition, previous research has emphasized the success of downstream based on increasing the number of investments and exports, while aspects of investment quality, green technology transfer, and the suitability of nickel industrialization with the principles of environmental sustainability have not received adequate attention.

Based on these research gaps, this study offers novelty by analyzing Indonesia's nickel downstream as a process of transforming foreign investment within the framework of a green economy. In contrast to previous research that focused more on aspects of economic growth and investment attractiveness, this study integrates the perspective of Ecological Modernization Theory (EMT) to explain the relationship between industrial modernization, FDI inflow, technological innovation, and environmental sustainability. The main contribution of this research is to position nickel downstream not only as an economic strategy, but as an industrial transformation process that must be assessed based on the balance between increasing economic competitiveness and achieving sustainable development.

METHOD

Research Design

This study uses a qualitative approach with a structured literature study design. This approach was chosen to study, interpret, and synthesize findings from various secondary sources in a systematic but flexible manner, in order to understand the dynamism of the relationship between nickel downstreaming, FDI transformation, and green economy in Indonesia.

Data Sources and Collection Strategies

Research data was collected from secondary sources in the form of articles in accredited scientific journals, official government reports (such as data from the Ministry of Investment/ *Badan Koordinasi Penanaman Modal*) and publications from international institutions. The literature search focused on the last 10-year period (2015–2025) to cover the period before and after the implementation of the nickel ore export ban policy. The search keywords used include: nickel downstreaming, Foreign Direct Investment (FDI), green economy and sustainability.

Literature Selection Criteria

To ensure the relevance and quality of the data, this study applied the following selection criteria:

1. Inclusion Criteria: (1) Publications that specifically discuss the context of nickel downstream in Indonesia; (2) Discuss aspects of FDI, value chain, or environmental impact; (3) Sourced from accredited journals or credible official reports.
2. Exclusion Criteria: (1) Literature that only discusses mining commodities other than nickel; (2) Opinion articles or popular news without a clear basis for data or academic analysis.

Data Analysis Procedure

To answer the methodological shortcomings that often occur in literature studies, this study applies Thematic Analysis in stages. The data analysis procedure is carried out through four main steps:

1. Data Familiarization: The researcher thoroughly reads the literature that has been collected to understand the context and main arguments of each source.
2. Coding: Important parts of the text (such as FDI data, government policies, and environmental impacts) are coded or labeled initially, to make it easier to organize information.
3. Theme Generation: Codes that have a charm are grouped into large themes. In this study, the themes formed are: (a) Shifting FDI patterns, (b) The role of nickel in the green economy, and (c) Sustainability challenges (ecological paradox).
4. Synthesis and Interpretation: The themes are then compared, discussed, and synthesized using the lens of Ecological Modernization Theory (EMT) to draw conclusions that answer the research objectives.

To provide a more comprehensive picture and improve methodological transparency, the stages of data analysis described above are visualized in a research flow chart as follows:(Subagiyo, 2015)

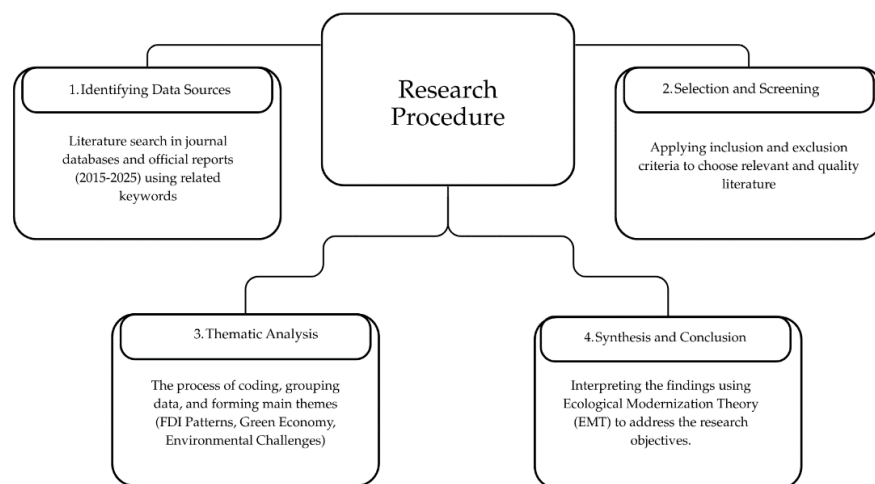


Figure 1. Research Procedure Flow Chart
Source : Processed from Rokhmat (2015, hlm.50)

RESULT AND DISCUSSION

1. Nickel Downstreaming, Green Economy, and Changing Foreign Direct Investment (FDI) Patterns

The development of Foreign Direct Investment (FDI) in Indonesia in recent years has shown a change in line with the increasing global attention to the energy transition and sustainable development. Foreign investment is no longer only oriented towards the use of natural resources, but also begins to consider aspects of industrial added value, production efficiency, and involvement in the green economy supply chain (Lahadalia et al., 2024).

In this context, nickel downstreaming is one of Indonesia's strategies to improve its position in the global value chain. Before the downstream policy was strengthened, Indonesia's nickel utilization still focused on the export of raw materials so that the

economic added value obtained was relatively limited (Kaplinsky & Morris, 2016). Indonesia plays more of a role as a supplier of raw materials in the international production chain. Through the implementation of the ban on the export of raw nickel ore and the obligation to process minerals in the country, there has been a change in the direction of foreign investment in the nickel sector. Investors who previously acquired nickel through international trade began to make direct investments through the construction of smelters, processing facilities, and nickel-based industrial estates in Indonesia (Warburton, 2017)

These changes show that the increase in FDI is not only influenced by Indonesia's large nickel reserves, but also by changes in industrial policies that encourage the creation of domestic added value. Downstreaming has changed the position of nickel from just an export commodity to part of technology-based industrial development strategies, especially in supporting the global demand for electric vehicle batteries. In addition to providing economic benefits through increased investment, exports, and job creation, nickel downstreaming is also beginning to be associated with the green economy agenda. This is because nickel is one of the key components in the electric vehicle industry that is part of a global effort to reduce the use of fossil-based energy.

2. Nickel Downstreaming as an Industrial Transformation Strategy and a Factor of Foreign Direct Investment (FDI) Attraction

The nickel downstream policy is part of Indonesia's efforts to change its economic structure from dependence on natural resource exports to the development of value-added industries. This change aims to make Indonesia not only a supplier of raw materials, but also able to take a greater role in the global production process (Morris et al., 2012)

The results of the study show that downstream has an effect on changing the character of foreign investment entering Indonesia. Prior to the restriction on nickel ore exports, investment in the mineral sector was more oriented towards mining activities and raw material trading. After the downstream policy was implemented, investment began to shift towards the development of the processing industry, smelters, refining technology, and supporting industries for electric vehicles (Warburton, 2017)

These changes show that the downstream influence is not only seen from the increase in foreign investment, but also from the change in the character of incoming investment. FDI in the nickel sector began to move from extraction-based activities to national industrial capacity activities (Sari et al., 2016). The increasing global demand for electric vehicles further strengthens Indonesia's attractiveness as an investment destination. Large nickel reserves provide strategic advantages for Indonesia as many international companies seek to secure the supply chain of raw materials for the clean energy industry (Botutihe, 2024). However, the development of nickel downstream also shows some challenges. The processing industry requires large capital and high technology, so there is still a dependence on foreign companies. Therefore, the success of downstream depends not only on increasing investment value, but also on Indonesia's ability to obtain technology transfer and increase the capacity of domestic industries.

3. Green Economy, Keberlanjutan Lingkungan, dan Tantangan Transformasi Investasi Hijau pada Industri Nikel

The development of the green economy concept has influenced the direction of global investment, including in the strategic mineral sector such as nickel. Foreign investment is no longer only valued based on economic benefits, but also on its contribution to environmental sustainability and the energy transition (Loiseau et al., 2016). Therefore, the integration and application of Environmental, Social, and Governance (ESG) principles is more transparent in the potential for downstreaming and the long-term impact provided by the company to investors and stakeholders. (V. M. Putri & Taurusianingsih, 2025)

In the Indonesian context, nickel downstream has a close relationship with the green economy agenda due to the increasing need for nickel as the main material for electric vehicle batteries. The global demand for electric vehicles provides an opportunity for Indonesia to attract foreign investment while strengthening its position in the clean energy industry (Sovacool et al., 2020). However, the implementation of the green economy in the nickel industry still faces various problems. The construction of smelters and processing facilities requires large energy consumption, while part of the production process still relies on fossil-based energy. This condition creates challenges because the final product of nickel supports the energy transition, but the production process can still produce environmental impacts (Botutihe, 2024).

In addition to carbon emissions, nickel mining and processing activities also have risks of land use change, environmental pollution, and pressure on the ecosystem around industrial estates. Therefore, the success of nickel downstream is not enough only to see the increase in FDI or export value, but also needs to pay attention to the quality of incoming investment. Foreign investment in the nickel downstream sector is expected to be able to support the application of cleaner technology, more sustainable energy use, and higher environmental standards so that the transformation towards a green economy can take place in real terms.

The results show that nickel downstreaming has become an important factor in changing the pattern of Foreign Direct Investment (FDI) in Indonesia. This policy has succeeded in changing Indonesia's position from a raw material exporting country to a location for the development of a mineral processing industry that has higher added value (Lahadalia et al., 2024). This change shows that Indonesia's investment attractiveness comes not only from the availability of natural resources, but also from industrial policies that create opportunities for the development of production chains.

In the perspective of Foreign Direct Investment theory, this phenomenon can be explained through location *advantage*, which is a condition when investors choose a country because it has strategic factors such as natural resources, supporting regulations, and market opportunities. Indonesia's nickel reserves are an initial attraction for investors, while downstream policies strengthen Indonesia's position as a center for the development of critical mineral-based industries. Thus, investment in the nickel sector has changed from resource seeking investment to investment that is more oriented towards strategic industrial development.

The transformation is also related to the concept of the green economy because the increase in nickel investment occurs along with the increasing need for low-carbon technology, especially electric vehicles. Nickel is no longer just seen as a mining commodity, but an important part of the global clean energy supply chain. This shows that natural

resources can be the foundation of new economic development if managed through technological improvements and industrial innovation.

When viewed through Ecological Modernization Theory (EMT), the development of Indonesia's nickel downstream can be understood as an effort to connect economic interests with the sustainability agenda. This theory becomes relevant because it puts in place the right technologies and policies, and changes in the production process. In the context of Indonesia's nickel downstreaming, the entry of FDI can be an opportunity to accelerate industrial transformation if the investment brings new technologies, improves resource efficiency, and supports low-carbon production (Satoh, 2025)

However, the application of green economy principles in Indonesia's nickel downstream still faces challenges. Increased investment and development of the processing industry have not automatically shown the success of green transformation if production activities still depend on fossil energy and generate environmental pressure. This condition shows the paradox that nickel is used to support electric vehicles, but the production process still has ecological risks (Setiawan et al., 2025)

Therefore, the success of nickel downstream needs to be assessed through the quality of investment, not just the amount of foreign capital that comes in. Ideal FDI not only boosts economic growth, but also encourages technology transfer, clean energy use, improved environmental standards, and the application of *Environmental, Social, and Governance* (ESG) principles.

Thus, nickel downstream can be an instrument of green economic transformation if Indonesia is able to integrate the interests of investment, industrial development, and environmental sustainability. Long-term success is determined not only by the ability to attract foreign investors, but also by the ability to ensure that nickel-based industrialization runs competitively and sustainably.

CONCLUSION

This study concludes that nickel downstream policies in Indonesia have successfully transformed the Foreign Direct Investment (FDI) landscape from a conventional natural resource extraction model to the development of strategic value-added industries that are integrated with the global supply chain of the green economy. However, through the lens of Ecological Modernization Theory, this transformation is still faced with a significant ecological paradox, where nickel's contribution to low-carbon technologies (such as electric vehicle batteries) is overshadowed by domestic production processes that still rely on fossil energy and have the potential to cause environmental degradation. Therefore, the long-term success of this downstream strategy can no longer be judged solely on the quantity of capital flows or export value, but must be measured by the quality of the investment in, especially in terms of green technology transfer, improved resource efficiency, and the implementation of strict Environmental, Social, and Governance (ESG) standards, to ensure that the modernization of the nickel industry is truly aligned with the principles of sustainable development.

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