

National Policy Regarding Nickel Mining Management in Southeast Sulawesi

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Abstract

Nickel is now an increasingly vital mineral in Indonesia, especially in national initiatives to encourage downstreaming, industrial development and domestic value creation. Southeast Sulawesi is a significant nickel producer with both economic opportunities and environmental, social and governance challenges arising from nickel mining and processing. This study focuses on national policies on nickel resource management in Southeast Sulawesi particularly downstreaming, industrial development, environmental management, socioeconomic impacts, and policy implementation. This study is a qualitative descriptive literature review. The relevant literature was identified by academic and institutional sources, such as Google Scholar, ScienceDirect, Scopus-indexed publications, government sources, official legal databases, journal articles, books, reports, legislation and other credible institutional documents. The collected literature were screened and subjected to thematic analysis to look out for similarities and relationships between national policy, industrial development, environmental management, social-economic conditions and governance. The findings suggest that national policy serves as the core source of regulation and strategy for the nickel resource, downstreaming gives nickel a new strategic significance as an element of a wider industrial development. Mining and processing can attract investment, jobs, infrastructure and other enabling enterprises, but also put strain on land, water, forests, coasts and local livelihoods. The study also reveals that maintaining sustainability in the management of nickel requires ongoing monitoring of the environment, reclamation, corporate compliance, institutional coordination, transparency and community involvement. In general, a holistic governance framework that links up economic growth and environmental protection, social welfare and responsible regional resource management is needed to implement nickel policy effectively. If policy implementation and enforcement at the regional level is not consistent, then it is not effective.

Keywords: Nickel Mining; National Policy; Environmental Management; Governance

Introduction

Nickel now plays one of the roles that is most strategic for Indonesia, both in terms of development of an industrial sector, mineral downstreaming, and transitions towards low carbon

technologies. Indonesia has significant nickel resources and is making a strong move towards making nickel a major pillar of its national industrial policy. Nickel is also an important component in the manufacture of stainless steel and in a number of battery technologies for electric vehicles. The Indonesian government therefore aims to shift from the primary raw mineral exports to processing and refining it at home. This policy aims to enhance the economic value added in Indonesia, spur industrial investment, provide jobs and build the strength of Indonesia's role in global mineral value chains. The growth of nickel mining and processing does present some good questions though, about environmental sustainability, social welfare, governance and even the equitable sharing of economic benefits. One of the important nickel producing areas in Indonesia is Southeast Sulawesi. There are extensive nickel deposits in the province, and the province has seen substantial growth in the mining and mineral-processing sector. The Konawe, North Konawe, South Konawe, and Kolaka regions which produce nickel have been more and more linked to the national development plans targeting industries. Being part of an expansion of mining activity, it has made a contribution to regional economic activity in terms of employment, business opportunities, infrastructure development and investment. Meanwhile, mining activities may cause pressure on forestry, farming land, water resources, coastal ecosystems, and livelihoods. The above facts are proof that the question of nickel mining management is not just an economic one. It's about how the national mineral policy, regional development, environmental control, community interests and corporate responsibilities all play into one another. The management of the nickel mining in the national level is regulated by the general regulation of mineral and coal that is set in Indonesia. The governance of mineral resources is mainly governed by Law No. 4 of 2009 concerning Mineral and Coal Mining (as amended by later laws). Regulatory system focuses on state control of mineral resources, licensing, managing production, environmental responsibilities, land reclamation and post-mining activities. The government has also put in place policies to grow domestic processing and refining capacity. Restrictions on raw nickel ore exports has been one of the key measures taken to promote investment in local smelter and downstream companies. This is what the government is trying to do, from changing the country from a supplier of unprocessed mineral resources to a producer of higher value mineral products, as reported by Sutisna et al. (2026), Paristiawan et al. (2026) and Patunru (2026).

The downstreaming policy has resulted in significant investments in nickel processing and supporting industries. The implementation of smelters and enabling facilities has enhanced the position of Southeast Sulawesi in the nickel-based industrial value chain in Indonesia. Downstreaming is policy driven and is projected to create a higher value added from domestic use than from exporting raw ore. It can also encourage job creation, technology transfer, infrastructure development and government revenue. However, the gains from the downstreaming are contingent on the effectiveness of governance and the degree of the distribution of economic benefits to local communities. Fast industrialization may pose problems on land use, working conditions, human migration, infrastructure and environmental management. The nickel mining policy is especially evaluated based on environmental concerns. The land clearing, excavation, transportation and waste creation associated with mining, as well as the potential for major alteration of soil and water systems, are the primary activities that pose risks to water. The major activities that pose risks to water are the land clearing, excavation,

transportation and waste creation associated with mining, as well as the potential for major alteration of soil and water systems. Where mining activities are near natural areas and agricultural and coastal communities, environmental effects could impact those who rely on agriculture, fishing and other natural resources. Therefore, the implementation of environmental impact assessment requirements, reclamation obligations, monitoring systems and post-mining responsibilities are essential. National policy should not just promote mineral production and industrial investment, but also take measures to ensure that mining companies meet environmental standards and restore areas impacted by mining operations (Pagouni et al., 2024; Gumbo et al., 2025; Joseph, 2025). A second dimension is the links between the national policy and local governance. The governance of minerals and mining has been nationalized and regulated on a national level, but is implemented in specific regional social, economic and environmental settings. There can be differing interests between local governments, communities, mining companies and others when it comes to the use of natural resources. This means that coordination between government institutions and involvement of affected communities are needed to implement a policy effectively. There needs to be transparency in licensing, environmental monitoring, land use, and corporate responsibilities as well to increase public accountability and mitigate potential conflicts. In this context, the analysis of the national policy on nickel mining management in Southeast Sulawesi is important to be done because it is necessary to gain insight into how the goals of mineral development in the national level are implemented in the region. The problem is a basic policy question in how best to generate the most economic and industrial benefit from nickel resources while at the same time keeping the environment sustainable and promoting the interests of local communities. In view of this, this study will concentrate on the national policy on nickel mining, implementation of the national policy in Southeast Sulawesi, and the economic, environmental and social effects of the implementation. They can help to better assess the nickel governance and serve as a basis for strengthening the sustainable and responsible management of mineral resources in Indonesia.

Methods

Research Design

Literature review research method with qualitative descriptive approach is used in this study to study the national policies regarding nickel mining management in Southeast Sulawesi. Literature review entails identifying, analyzing, comparing and synthesizing information from already existing academic publications and policy documents. This method is fitting as the study is dealing with the understanding of the process of how the national nickel mining policies are developed, how they are implemented in Southeast Sulawesi, and the economic, environmental, social and governance impacts of the policies. The review centers on literature addressing the governance issue of nickel mining in Indonesia, the issue of downsteaming, environmental management, mining regulation and the effects of mining on the local population, as well as the linkage between the national policy and the regional implementation. The analysis is not a primary data collection that involves conducting surveys or interviews. Rather, conclusions are built upon the systematic study and synthesis of secondary sources.

Literature Search Strategy

Several academic and institutional databases such as Google Scholar, ScienceDirect, Scopus indexed journals, government websites and official legal databases were used for the literature search. The search has been done by using combinations of words associated with the topic of the research. The main keywords used were: nickel mining in Indonesia, nickel mining Southeast Sulawesi, nickel mining policy, mineral downstreaming Indonesia, nickel governance, environmental impact of nickel mining, nickel mining communities, and mining policy in Southeast Sulawesi. The search strategy aimed to find literature that directly involves the policies and implementation of nickel mining at the regional level in Indonesia. Other searches were done with combinations of search terms including nickel, Southeast Sulawesi, mining regulation, environmental sustainability, downstreaming, and mineral governance. Some of the articles reviewed were selected for their relevance to the topic, with the corresponding references also reviewed to find other literature which could be included in the analysis.

Sources and Selection Criteria

The literature reviewed includes peer-reviewed journal articles, books, conference publications, government publications, official statistical publications, legislation, or other credible institutional publications. Special focus was placed on publications published in the recent period, so as to be able to keep track on the developments of the Indonesian nickel policy and the fast development of downstream industries. Older publications were also included if they contained important theoretical background or historical information relevant to the topic of mining governance and environmental management. Several criteria were used to select the literature. First, the source had to be related to the theme of nickel mining, mineral governance, environmental management, downstreaming, and/or the social and economic effects of mineral mining. Second, the source should have identifiable data about Indonesia and/or if possible, Southeast Sulawesi. Thirdly, preference was accorded to scholarly and authoritative sources, where there was clear evidence of the source's publication. Data that lacked sufficient methodological data, was of uncertain institutional origin, or was not directly relevant to the research goal were not included in the primary analysis.

Data Collection and Literature Screening

The process of collection of literature involved various phases. A first step was to find potentially relevant publications with appropriate keywords in online searches. In the second stage, titles and abstracts were screened to determine whether the publications were related to the research objectives. Books that were obviously not related to nickel mining policy and the Indonesian context were not included. The full texts of potentially relevant publications were then reviewed. Data from the selected literature was analyzed for several analytical categories, which included national mining regulations, policies in nickel downstreaming, environmental impacts from nickel mining, economic contributions, social impacts, and institutional governance, as well as policy implementation in Southeast Sulawesi. Information relevant to those themes was arranged in this way so that it could be compared to the information in other sources.

Data Analysis

Qualitative analysis of the collected literature was done by the thematic analysis and qualitative synthesis. A thematic analysis technique was applied in order to find out the different themes,

similarities, differences and relationships in the findings reported in the selected literature. The analysis was done in several main themes, including national nickel mining policy, downstreaming and industrial development, environmental management, social and economic impacts, and governance and policy implementation in Southeast Sulawesi. The data collected from various sources were juxtaposed to establish similarities and differences. The formal policy framework was explored through government regulations and official reports while academic literature was used primarily to understand the impacts, implementation and scholarly interpretations of the policy. When sources gave conflicting results, the differences were presented and taken into account in respect of the context of their research, their method of research and the time span that they covered.

Validity and Reliability of the Review

The study emphasises on the relevance and credibility of the literature review by focusing on academic journals (peer reviewed) and official government institutions. When possible, information on laws, regulations and government policies is verified against official legal or government sources. The arguments used in academic writing are contrasted between several publications, and not just one. The review also takes into account the year of publication and the relevance of each source, especially as Indonesia's nickel policy has been undergoing many changes in recent years. The study aims to give a balanced picture of the development and implementation of national nickel mining policy in Southeast Sulawesi by comparing academic literature with official policy documents and institutional reports related to this.

Research Procedure

The overall literature review process includes five key steps: identifying, screening, eligibility assessment, data extraction, and thematic synthesis. Academic databases and official sources are used for the identification of relevant literature, first. Secondly, titles and abstracts are reviewed based on the inclusion criteria. Third, other full-text sources that may be relevant are evaluated for eligibility. Fourth, significant information is extracted and sorted into the analytical themes that are pre-established. Finally, findings are synthesized to explain the relationship between the national nickel mining policy and implementation and impacts in Southeast Sulawesi. The literature review method is used in this research to obtain a structure basis for analyzing the effects of national policies on the mineral development in Southeast Sulawesi and how national policies related to the economic development, environmental sustainability, social interests, and the good government of nickel mining.

Results and Discussion

Table 1. Results of the Literature Review

Analytical Theme	Main Findings from the Literature	Interpretation
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National mining policy	National regulations provide the legal framework for mineral resource management, licensing, production, environmental obligations, reclamation, and post-mining activities.	Nickel mining in Southeast Sulawesi is strongly influenced by national policy and regulatory decisions. Regional implementation must therefore operate within the national mining governance framework.
Nickel downstreaming	Government policy has encouraged domestic processing and refining rather than relying exclusively on exports of raw nickel ore.	Downstreaming changes nickel mining from a resource-extraction activity into part of a broader industrial development strategy.
Industrial development	The expansion of nickel processing has encouraged investment in mining-related infrastructure and processing facilities.	The policy can generate additional economic activity and strengthen the role of Southeast Sulawesi in Indonesia's mineral-based industrial development.
Environmental management	Mining activities may place pressure on forests, agricultural areas, water resources, soil, and coastal ecosystems.	Economic benefits from nickel development need to be accompanied by effective environmental assessment, monitoring, reclamation, and post-mining management.
Local socioeconomic impacts	Mining and processing activities can create employment and business opportunities but may also affect agricultural, fisheries, and other local livelihoods.	The socioeconomic effects of nickel development are not uniform and depend on location, community involvement, employment opportunities, and distribution of economic benefits.
Governance	Implementation involves central government institutions, regional governments, companies, and local communities.	Effective coordination, transparency, supervision, and community participation are important for translating national policy into responsible regional mining management.
Sustainability	The literature emphasizes the tension between rapid mineral-based industrial development and long-term environmental and social sustainability.	Sustainable nickel governance requires economic development to be integrated with environmental protection and social considerations rather than treated as separate policy objectives.

National Policy and Nickel Resource Management

The literature suggests that the nickel mining management system in Southeast Sulawesi is not

independent of the general national mineral governance system in Indonesia. National policy sets out the general principles for the exploitation, licensing, production, environmental obligations, reclamation and post-mining obligations of minerals. The regulations create the institutional framework on which mining companies operate, and regulate access to, use of and management of mineral resources. In this context, nickel is not only considered as a natural resource but as a strategic national resource, with its exploitation linked to the broader goals of economic development and resource governance. Thus, the governance of nickel resources in Southeast Sulawesi is a reflection of the relationship between the national level regulatory authority and the reality on the ground, on the local level. Based on the analysis, the national nickel policy has two similar goals: maximizing the contribution of mineral resources to economic development, and at the same time imposing regulatory restrictions on the utilization of the nickel resources. The economic aspect is manifested in the attempts to enhance the value of the products produced in the country, encourage investments, promote mineral-based industries and create jobs and revenues for the government. Meanwhile, regulatory regimes are designed to ensure mining continues to be subject to controls for production, environmental obligations, environmental reclamation and post-mining obligations to license. The double orientation illustrates the balancing act between the use of the resources and regulation in national nickel policy. However, implementing the requirements in the formal policy is not sufficient; the capacity of the institutions and mining operators to do so consistently across the mining life cycle is also vital to the effectiveness of the policy. However, national policy has several implications, especially in the field of regional development, for Southeast Sulawesi, which is one of the provinces that has a potential nickel mining industry and has grown more and more linked to the overall mineral-based industrial policy in Indonesia. National policy decisions regarding the use of nickel resources and development of the downstream areas can shape the nature and location of investment, infrastructure development, employment opportunities and development of supporting economic activity in nickel production areas. But the impact of a national policy on a region is not always even. Mining development could also provide local businesses and employment opportunities, but also place pressures on agriculture, fisheries, water, forests, and other community assets. Thus, the application of national nickel policy must take into account the local socio-economic and environmental conditions, and not only the aggregate indicators (production, investment, industrial growth). The findings, therefore, suggest that the policy of nickel must be analyzed not only in the light of mining policy but also as part of the national industrial, environmental, investment and regional development policy. It is to be achieved by aligning economic goals and effective governance mechanisms and safeguarding community interests. In Southeast Sulawesi, this involves the coordination of national and regional government institutions, as well as between mining companies, local communities, and relevant stakeholders. Transparency of licensing, regular environmental monitoring, corporate compliance, reclamation and meaningful community involvement are all of special concern in the implementation of national policy into responsible resource management. Therefore, the national policy acts as a political and regulatory platform for nickel development, but can be looked at in terms of its overall developmental potential, which is closely tied to the ability to implement it at the regional level and to achieve economic viability without compromising environmental sustainability and local livelihoods.

Downstreaming and Industrial Development

One of the main conclusions of the literature search is the significance of the policy on downstreaming of the nickel sector, which is one of the most extractive sectors in Indonesia, to become a more integrated industrial sector. The policy does not focus on the export of raw mineral resources, but on the processing and refining of raw materials within Indonesia, to generate value from nickel as much as possible. This policy orientation is a major change in the positioning of mineral resources in national development. Nickel is now considered more than just an export product, but also an input for local industrial production and value chains. The government aims to bolster the country's industrial capabilities, thereby inviting investors to develop nickel-processing facilities and to boost the economic value obtained from Indonesia's vast nickel resources, through the rise of processing and refining capacity. The downstreaming agenda is thus a way of linking resource extraction with the greater economic development of the country, instead of the economic values of nickel being enjoyed at the production of raw materials stage. The impacts of downstreaming are much broader than just the mining industry for Southeast Sulawesi. The development and growth of processing facilities generates economic connections between mining operations and a variety of complementary services such as transportation, energy, construction, logistics, equipment provision and other business services. These connections can stimulate the economies of the mining region and provide additional job and business opportunities. From this perspective, down-streaming might help to create a larger industrial complex where nickel mining is linked with processing, infrastructure and ancillary economic activity. The changing nature of nickel is significant in terms of regional development because the importance of nickel is no longer just linked to the amount of ore mined. Rather, development of downstream industries can shape the regional economic activity by providing new linkages amongst the mining industry and other productive industries. Based on that, the national downstreaming policy can be used to enhance the strategic position of Southeast Sulawesi in the national mineral-based industrial development. In parallel, the literature indicates that industrial development linked to the downstreaming process brings new types of resource requirements and growing complexity in managing development in a region. The processing facilities will need significant infrastructure support and can drive up the demand for land, energy, water, infrastructure etc. Mining and processing operations, therefore, may be intensive and put additional strain on the existing infrastructure and environmental systems. These conditions illustrate that downstreaming should not be defined solely based on an investment increase or processing capability or an economic activity increase. Developing the industry should also take into consideration the spatial organization, environmental carrying capacity, infrastructure and the interests of communities in and around the industrial zone. Substantial economic opportunities may be accompanied by new governance challenges if expansion in industry happens too quickly and without proper planning. Therefore, a policy framework that can effectively coordinate the development of downstream industries and the natural resources/environmental protection/socio-economic conditions is needed. The results therefore suggest that the downstreaming should be included in a comprehensive approach to industrial development, not as a downstreaming policy aimed at setting up mineral-processing enterprises. The spatial planning, infrastructure development, environmental protection, regulatory supervision and monitoring of the industrial development process is essential to effective

downstreaming. It is also essential that there is coordination between government institutions, mining and processing companies, local communities and other stakeholders to ensure that industrial development is aligned with regional development goals. In Southeast Sulawesi, the long-term potential of downstreaming is also dependent on the potential to improve the domestic value of nickel, as well as the capacity to manage the environmental and social impacts of intensified industrial activities. An economic downstreaming strategy, therefore, should aim to maximise the economic linkages created by the nickel, while preserving environmental protection and ensuring that regional development is not in conflict with the needs and interests of affected communities.

Environmental Implications

The environmental management is one of the most prominent themes that were found in the literature related to nickel mining in Southeast Sulawesi. Nickel mining activities involve a series of operations which can change the physical and ecological properties of mining areas, such as land clearance, excavation, transportation, stockpiles, and waste management. It is important because of the cumulative nature of these activities, as environmental pressures can be present outside the immediate scope of the mining activity. If mining operations are situated close to agricultural lands, forests, water bodies and coastlines, changes in land and environmental conditions could impact communities that rely directly on natural resources. Therefore, environmental implications need to be considered as part of the wider management implications of the nickel development and not as a standalone problem in the production of the nickel. This view underscores the importance of environmental factors in the planning, operation, supervision and closure of mining operations. The potential environmental impacts of nickel mining are also illustrative of the need to manage mining operations during the entire life-cycle. Landscape alteration due to land clearing and excavation may impact soil properties, and transport and stockpile can cause further stresses to surrounding water and landscape systems. The additional waste produced as a consequence of mining and processing activities only exacerbates the need for good environmental management. When mining activities are in close proximity to agricultural and coastal activities, concerns may become more relevant as the environmental changes could have implications on productive activities and livelihoods. The literature also suggests that environmental management should not be confined to dealing with the environmental effects of individual projects once they have taken place. Rather, there should be a preventive plan, proper operational controls, periodic evaluation and continual monitoring for the detection and remediation of environmental hazards as the mining activity evolves. The results also highlight the need to combine the implementation of the EIA, compliance monitoring, reclamation and post-exploitation rehabilitation within the framework of a responsible management of nickel resources. Environmental impact assessment is important for determining potential environmental effects prior to and during the development of a mining operation and compliance monitoring is required to ensure that mining operations are not adversely affecting the environment through pollution or deterioration. Along with reclamation, post-mining rehabilitation is also essential as the environmental obligation of the mining company should not end with the mining itself. This means that the concept of environmental governance should not be considered as an one-off regulatory obligation, one which is primarily linked to mining

approvals. Environmental responsibilities need to be ongoing throughout the mining life cycle, from the planning and approval stage to the mining, processing, closure/closure, reclamation and post closure stage of the project. As a broad policy and management issue, the environmental results also reveal the need for effective environmental governance as a complement to economic development resulting from nickel mining. To preserve environmental responsibilities in tune with the scale and intensity of mining activities, monitoring, institutional supervision, corporate compliance, and suitable rehabilitation mechanisms need to be put in place. This is especially relevant in Southeast Sulawesi, where mining activities are developing on agricultural lands, near coastal regions, and within natural resource-resource dependent communities. Based on the literature, it is clear that environmental protection is not an external constraint imposed on mineral development, but rather it is an integral aspect of sustainable management of the nickel resource. The long-term success of the nickel policy will rely on the ability to align the production goals with environmental assessment, monitoring, reclamation, and post-mining obligations to make sure that resource development can be managed to support broader environmental and regional development concerns.

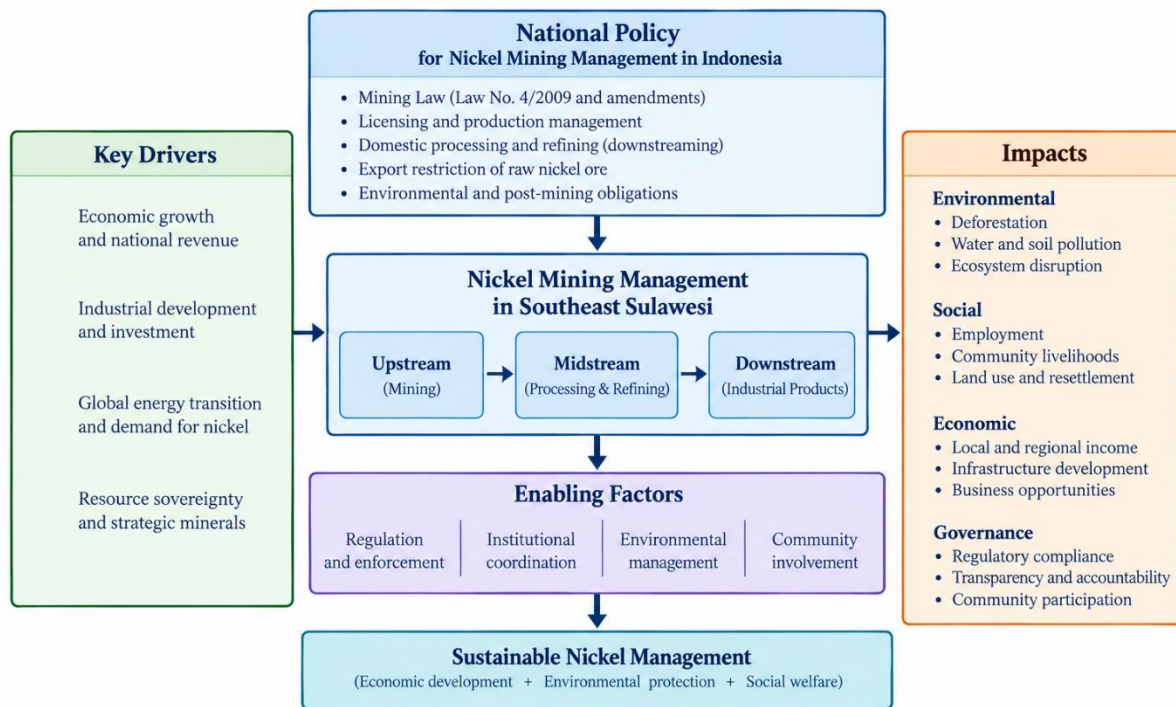


Figure 1. National Policy Pathway for Nickel Mining Management

Figure 1. The relationship between national policy and regional nickel management. National policy establishes the regulatory foundation, which is implemented through mining activities and downstream industrial development. These activities can generate economic and employment benefits, but their sustainability depends on environmental and social governance. The figure therefore demonstrates that economic development and environmental management should be treated as interconnected components of nickel policy.

Socioeconomic Impacts

The literature review pinpoints opportunities and challenges of the socio-economic effects of nickel mining and processing in the Southeast Sulawesi region. The positive aspect of the expansion of mining is that it can provide direct employment in the mining industry and indirect employment in other supporting industries such as transportation, construction, equipment supply and others. Mining and processing industries could make trade and service offering attractive for local businesses to become involved in mining-related economic activities and stimulate demand for goods and services. Moreover, the construction of mining infrastructure and related facilities can help to bring about changes in the economic activities in the region and enhance regional access to infrastructure. These impacts suggest that the nickel development has the potential to play a significant role in stimulating the local economy, through linkage to other parts of the regional economy. But the socio-economic impact of nickel development does not always affect equally all the members of the local community. Mining and related industrial activities could involve land use changes and impact on access to agricultural land, coastal areas and other natural resources. These modifications are especially significant for the agriculturalists, fishers, and others who make their living from the environment. This means that the economic opportunity benefits of mining can co-exist with livelihood challenges faced by specific community groups. This demonstrates that socioeconomic impacts should be assessed beyond the gross economic value created by mining activities, and also the differential impacts on access to resources and the environment on various segments of the local population. It is therefore important to consider the distribution of opportunities and costs as a dimension in the evaluation of regional impacts of nickel development. The literature also indicates that employment alone is not a good measure of socioeconomic improvement. The quality and availability of employment opportunities, the involvement of local communities in activities related to the mining industry and the potential benefits of local businesses to the growing industrial cluster also play a role. If mining development creates new economic opportunities, then the extent to which these opportunities are open to the people in the locality can affect the socioeconomic impact of the policy. In contrast, alterations of land use and environment can also affect the ability of communities to sustain their traditional livelihoods. This implies that the socioeconomic opportunity cost of industrial development and the impact on existing livelihoods must be taken into account. This method can give a more holistic picture of regional impacts on communities by nickel development. The results of the study suggest that the development of the nickel industry from the policy and management point of view should not be judged only by the indicators of investment, production, or industrial development. While these are indicators for measuring economic development, they do not fully reflect community outcomes. The implementation of the nickel policy should also be evaluated in terms of the following: community welfare, quality of jobs, livelihood protection, involvement of local businesses, and equitable distribution of economic benefits. This means for Southeast Sulawesi, the socioeconomic management must be integrated with the activities of mining and industrialization through appropriate community engagement, socioeconomic issues, and mechanisms to provide opportunity for local communities to participate in the benefits of nickel-related activities. The overall message is that sustainable nickel development has to involve economic growth linked with social aspects, which means that the growth of the mining and processing industry has to be evaluated by not only its economic impact on the region but also

its impact on the welfare and livelihoods of affected communities.

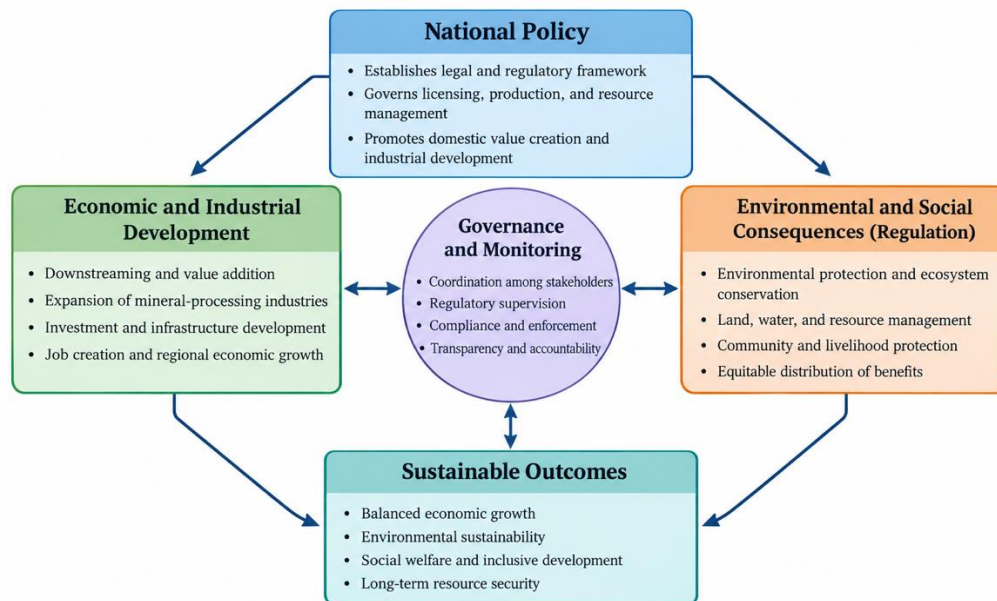


Figure 2. Thematic Relationship Identified in the Literature

Figure 2 shows that the major themes identified in the literature are interdependent. National policy encourages economic and industrial development, while regulation is intended to control the environmental and social consequences of resource exploitation. Governance and monitoring function as the connecting mechanism between policy objectives and sustainable outcomes. The findings therefore suggest that the effectiveness of nickel policy depends not only on the formulation of national regulations but also on their implementation and enforcement at the regional level.

Discussion

Based on the results of this literature study, it can be concluded that the national mineral policy and regional implementation are the key factors that shape the fundamental aspects of nickel mining management in Southeast Sulawesi. The policies are set at the national level and the experiences and implementation of the policies in practice are shaped by the regional conditions. National regulation is one of the institutional bases that regulate mineral exploitation, licensing, production, environmental responsibilities, reclamation and post-mining activities as identified in the literature. Meanwhile, the nickel industry has been shifting its focus towards a wider national development agenda focused on domestic value creation, industrialisation, investment and downstream processing. The shift from the traditional resource-extraction policy regime to a more complex scenario, in which mineral resources are intended to help drive industrial transformation, is a sign of nickel governance in Indonesia. The national orientation is very important for Southeast Sulawesi, as the province is more and more involved in the industrialization process of Indonesia based on nickel exploitation, processing facilities, infrastructure and economic activities. Thus, the results indicate that a national policy (institutional and industrial) is necessary to understand the regional nickel management;

otherwise, nickel management in a region can only be understood in mining activities. (Bradley et al., 2025; Pagouni et al., 2026; Kadir et al., 2026; Pambudi, 2025). One of the key implications from this finding is that the fact that a national nickel policy is effective and good is not only dependent on the quality and comprehensiveness of the formal policy, but also on the ability to implement the policy in a consistent manner. The literature indicates that national policy is a mixture of both economic development and regulatory control. While on one hand the extraction of minerals is supposed to attract investment, job creation, industrial development and generate government revenue, on the other hand, it is still required to comply with environmental, licensing, production, reclamation, and post-mining requirements. These goals are not mutually exclusive, but they must be coordinated and effectively implemented to co-exist. In the Southeast Sulawesi context, implementation occurs in various environmental and socio-economic conditions, and a national level standardised regulatory framework needs to engage with local conditions related to agricultural land, coastal ecosystems, livelihoods dependent on natural resources, communities and regional infrastructure. The issue of governance is therefore captured within this discussion, particularly in relation to institutional capacity to manage the regional impacts of national economic goals. The downstreaming policy is the most tangible aspect of this shift in nickel governance in Indonesia. The literature shows that downstreaming is intended to move nickel business development away from the export of raw mineral resources to local processing and refining, which will increase the value added in domestic development within Indonesia. In this regard downstreaming alters the economic connotation of nickel mining. The mining sector is linked to a much larger industrial value chain that includes processing, transportation, energy, construction, logistics, equipment supply and other activities. This opens the opportunity for Southeast Sulawesi to have more diversified regional economic structure, where the benefits of nickel are not only limited to extraction activities. Development of processing facilities can stimulate investment, supporting industries, and increase the contribution of the province to the mineral-based industrial development in Indonesia. The importance of downstreaming is not only that it adds processing power, it's that it can create better connections between natural resource extraction and regional economies.

The results show, however, that the downstreaming adds an additional level of management complexity. A significant amount of land, energy, water, transportation and environmental-management capacity is needed for industrial development. Thus, with the potential of economic gains, there are also potential pressures that can be generated by activities being increased in the downstream direction. This indicates that only downstreaming indicators (like investment, processing capacity, or industrial expansion) should not be used to assess downstreaming. More detailed evaluation should be made to determine the compatibility of industrial development with spatial planning, infrastructure capacity, environmental conditions and communities located around the field of mining and processing. That is, a governance responsibility is generated beyond the mining sector per se, with downstreaming. The establishment of an industrial ecosystem demands coordination on several fronts, such as mineral management, spatial management, infrastructure planning, environmental protection and socioeconomic development. The literature, therefore, is the one that supports the interpretation above, that the implementation of downstreaming is better interpreted as a regional development strategy rather than a mineral processing policy (Haryani & Oktaviani, 2026; Asyono et al., 2026; Vivoda,

2026). The environmental aspect of the results also illustrates the need for an integrated approach. The extraction of nickel can change the environment of the area, with activities such as land clearance, mining, transportation, stockpiling and waste disposal contributing to these changes. The pressures are particularly significant if they are near coastal and water resources, forests, and agriculture. The impacts can reach far beyond those on the environment and can impact community members who rely on agriculture, fisheries, and other natural resources for their livelihoods. The literature thus shows that environmental management is not a secondary consideration that is to be addressed after the economic development. Rather, environmental governance is part of the management of mineral resources. This is especially important in a setting where mining and processing activities might expand, thereby impacting the scale and intensity of resource utilization. Environmental considerations must therefore be taken into account at the planning stage and from the outset rather than as an afterthought when environmental issues become apparent. The results on environmental governance also suggest that the responsibility for regulating environmental issues needs to be spread along the mining life cycle. The components of the EIA are not administrative requirements that are separate from each other, but rather they are interdependent. Environmental impact assessment helps to predict the potential impacts, and monitoring helps to establish if these are in line with the environmental requirements. This responsibility doesn't end once the mining has taken place, though – reclamation and post-mining rehabilitation continue. The life cycle approach is significant as the environmental impacts and management needs can differ according to mining development, production and closure. Therefore, it is not enough to have environmental regulations at the approval phase. Good environmental management must therefore be consistently supervised by institutions and enforced by companies during the entire life of the mine. This interpretation reinforces the argument of the study that effectiveness of policies is influenced not only by the formal rules, but also by the quality and continuity in implementation.

The socioeconomic results are also complexly linked to the development of nickel and regional welfare. Literature indicates that the benefits of expansion of mining and processing operations could include employment creation, local business opportunities, demand for goods and services, infrastructure development, and enhanced regional economic activity. These impacts show that nickel development can provide significant economic linkages beyond the nickel companies. But the results also indicate that these benefits are not necessarily evenly spread throughout the local communities. Farmers, fishers and other groups that rely on the environment could be impacted by changes in land use and environmental conditions. So, an overall measure of economic growth may not reflect the courses of those communities that are impacted. A region might see more investment and industrial development, but a specific group of people may also see their access to land, natural resources and/or traditional livelihoods change. This distributional aspect is therefore crucial for grasping a more comprehensive socio-economic impact of nickel policy (Hanafi, 2026; Hanafi, 2026; Hidayat, 2026). The results, moreover, indicate that job creation needs to be measured by the quality of jobs created, their availability, and how well local communities participate in these opportunities. The ability of local residents to enjoy the benefits of mining employment and businesses may affect the distribution of the economic benefits of nickel development. In the same way, where mining alters land use or the environment, the capacity of local communities to continue or adjust their existing

livelihoods is a key factor to be taken into account. Socio-economic assessment should include measures of community welfare, employment quality, livelihood protection, community participation in local businesses and the distribution of benefits, in addition to more traditional economic measures. This extends development from economic growth to the quality and inclusiveness of the results of economic growth. This gives a more holistic perspective on the ability of the areas of Southeast Sulawesi that are producing nickel to meet the requirements of the welfare of the region. One of the key results of the results is governance and monitoring as a linkage between national policy and economic, environmental and socioeconomic outcomes. The goals and regulations outlined in the national policy, the economic opportunities provided by mining operations and the potential environmental and social effects. How these competing dimensions are coordinated in practice is governed. It is therefore very important that there is institutional coordination between government agencies, mining and processing companies, local governments, communities, and other stakeholders. Transparency in licensing, regulatory supervision, environmental monitoring, corporate compliance and community involvement is not a "mere" administrative matter but a means of achieving policy impacts in the region. This is the reason that the similar policy goals can have varying impacts in specific geographic areas, depending on how well the policy is implemented and governed. The literature-based thematic relationship consequently suggests a greater understanding of sustainable nickel governance. Economic development, environmental protection and social welfare should not be considered as separate issues to be addressed in a step-by-step manner. Instead, they are interdependent and need to be coordinated via governance and monitoring. Downstreaming may create economic benefits and support industrial development, if managed in a way that addresses the long-term regional impacts of land, water, infrastructure, environmental risks and community interests. Likewise environmental regulation can offer formal protection but it is contingent upon ongoing monitoring, compliance, enforcement and institutional capability. The results of this study indicate that sustainability is more fundamentally a matter of implementation: a national level policy framework provides the foundation, but implementing it at the regional level is the key to achieving sustainable outcomes. In general, this study adds to the knowledge of nickel resource management, as the national nickel policy in Indonesia has implications on various and interrelated aspects of regional development. The debate is not about whether nickel should be perceived as an economic resource or an environmental and social issue, it is about how both aspects can be managed within a coherent policy framework. The case of Southeast Sulawesi is a good example of this complexity as the province is an example of a place of mineral extraction, industrial development, interaction with the environment and livelihood of the community. The literature thus underpins a governance approach in an integrated manner, where the national policy sets the strategic direction, the downstreaming establishes industrial and economic linkages, the environmental management offers ecological safeguards, the socioeconomic management offers community welfare benefits, and the governance and monitoring link the various elements. This integrated approach will give a better analytical foundation for understanding the implementation of the nickel policy and assessment of its meanings for sustainable and responsible management of mineral resources in Southeast Sulawesi.

Conclusion

Based on the results of this study, it is concluded that the national policy has a fundamental role in determining nickel resource management in Southeast Sulawesi in the form of regulations related to the exploitation of the mineral, downstreaming, environmental management and post-mining responsibilities. The literature shows that downstreaming has facilitated the emergence of nickel beyond its role as a raw material by facilitating domestic processing, investment, employment, infrastructure development, and industrial linkages. These economic opportunities, however, come with environmental and socioeconomic challenges, however, including, but not limited to, land, water, coastal ecosystem and livelihood pressures dependent on natural resources. The results thus show that assessing the efficacy of the nickel policy can not only be based on production, investment, and industrial growth but also on environmental sustainability, community welfare, livelihood protection and the equitable distribution of economic benefits. In general, the management of nickel resources in a sustainable manner needs robust governance, ongoing monitoring, coordination among institutions, compliance from nickel companies, transparency, and active involvement from the local community to realize national policy goals to develop the region of Southeast Sulawesi in an environmentally responsible and sustainable way.

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