MANIFESTATIONS OF ECOLOGICAL JUSTICE IN POST TIN MINING RECLAMATION; AN INDONESIA-CHINA COMPARATIVE STUDY

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Abstract *– This study examines the tension between economic growth and environmental sustainability in China and Indonesia, both major tin producers. Extensive tin extraction in these countries has led to land degradation, metal contamination, and unequal distribution of benefits for nearby populations. Although both nations have post-mining reclamation laws, their implementation has not been thoroughly analyzed through the lens of environmental law theory. This research aims to compare the regulatory frameworks and reclamation methods in China (Gejiu, Yunnan) and Indonesia (Bangka Belitung) while assessing their alignment with ecological justice. Using doctrinal legal research and a comparative approach, the study analyzes legislation, court rulings, government reports, and case studies. It focuses on three areas: (1) the application of the polluter-pays principle and precautionary approach; (2) public engagement techniques; and (3) the gap between legal standards and implementation. Findings show that China lacks procedural justice due to limited public participation but excels in law enforcement consistency and technological integration. In contrast, Indonesia's participatory model faces challenges due to weak oversight and local elite co-optation. Neither country fully embraces the rights of indigenous peoples. This study recommends policy synergy, with China adopting Indonesia's participatory model and Indonesia enhancing technology-driven law enforcement like China's.*

Keywords*: Post-mining reclamation; Sustainable mining governance; Ecological restoration policy;*

INTRODUCTION

Mining is one of the activities involved in managing the country's natural resources. In addition, mining companies have an important function in increasing national per capita income and can substantially contribute to society. Mining activities will have both adverse and beneficial impacts. The good effects may not outweigh the negative consequences resulting from mining activities. Mining activities will always impact the environment (Oyarzo & Paredes, 2019) . Indonesia is one of the countries in the world that has experienced significant environmental degradation as a result of mining activities. The expansion of mining land does not seem to be in line with the awareness of the environmental impacts caused. Environmental damage caused by mining activities includes the extent of mining land classified under the Mining Authorization (KP) that is damaged after mining activities.

Every mining business carried out greatly affects the environment, both directly and gradually. Changes in natural ecology are also determined by human attitudes and protection of the environment. So that nature, which is a source of supply of excavated materials (natural resources), after being utilized, the results should not be left without recovery in accordance with the initial conditions because it will have an impact on the balance of ecosystems, ecology, and cause damage to nature or the environment. Nature that exists physically can be utilized for the benefit of humans in search of a better and healthier life, because a number of living things always interact, have a reciprocal relationship with other objects around them, therefore environmental balance needs to be a special concern, both from the miners (companies), government and society. If prevention and restoration of ecological conditions are not carried out as early as possible, the consequences will be felt by the next generation and will interfere with human rights in obtaining a clean and healthy environment (Rousseaux et al., 2017) .

The post-tin reclamation policy has a deep philosophical foundation, rooted in the principles of sustainability and justice that govern how humans should interact with nature, as well as the social responsibility that the industrial sector should carry out. The main principle underlying this policy is the

understanding that the exploitation of natural resources, such as tin, must be done with due regard to the long-term impacts on ecosystems and human life. Reclamation is not just the physical restoration of damaged land, but also part of the moral responsibility to repair and restore the damage caused by mining activities, as well as to ensure that natural resources are used wisely and do not destroy the balance of nature (Ullah et al., 2019) .

The first philosophy underlying the post-tin mine reclamation policy is the principle of intergenerational equity. This principle refers to our responsibility to preserve the environment, not only for our current needs, but also for generations to come. In this context, reclamation is an action to ensure that land that has been used for tin mining activities can be reused by future generations in a better condition, or at least no worse than the previous condition. Sustainability is a key pillar in reclamation policy, as land that has been disturbed by mining activities leaves not only physical damage but also potential ecological damage that can affect the wider ecosystem. With reclamation, we give future generations the opportunity to utilize existing natural resources without compromising the sustainability of their environment. Through reclamation, this principle of justice is translated into concrete actions that serve to restore the condition of land and ecosystems that have been damaged (Haryadi et al., 2023) .

The principle of social responsibility is also an integral philosophical foundation of post-tin mining reclamation policy. Mining, while providing significant economic benefits to the state and region, also often causes great environmental damage. Therefore, tin mining companies have a moral obligation to not only pursue short-term profits, but also to make positive contributions to society and the environment. Reclamation is one form of such social responsibility, which requires mining companies to carry out environmental restoration after mining activities. This reclamation process not only includes the physical restoration of land, but also involves social and economic improvements for directly affected communities, such as through community empowerment programs and sustainable natural resource management. In this context, reclamation is not only about repairing the damage caused by mining activities, but also about providing opportunities for communities to experience the long-term benefits of the reclamation process, both in terms of their economic, social and quality of life (Ibrahim et al., 2018) .

The principle of ecological responsibility in post-tin mining reclamation policy also includes aspects of wise natural resource management. Reclamation must be carried out by taking into account the ecological characteristics of the affected area, as well as considering the existing biodiversity. This philosophy demands that any reclamation activities are carried out with an approach based on ecological principles, which not only repairs physical damage but also recreates natural habitats for flora and fauna that may have been lost due to mining activities. This ecological responsibility is not only limited to the restoration of soil and vegetation, but also includes the overall management of water, air and biodiversity resources, so as to minimize negative impacts on the environment and create sustainability that can be enjoyed by surrounding communities in the long term (Chamid et al., 2020) .

In relation to tin post-mining reclamation policy, there is also a philosophical foundation related to the role of government and society in maintaining environmental sustainability. The government has the responsibility to formulate policies that can firmly and clearly regulate the implementation of reclamation, ensuring that mining companies carry out their reclamation obligations in a manner that complies with applicable standards. On the other hand, communities also have an important role to play in preserving the post-mining environment. Through active community participation in the reclamation process, they can oversee reclamation implementation and contribute to maintaining environmental sustainability. In this case, the government and the community work together to ensure that reclamation is not just a legal obligation, but also part of a joint effort to preserve the earth for future generations. Ex-mining land will usually experience physical, chemical and biological degradation. Dredging, stockpiling and compaction activities with heavy equipment adversely affect soil texture and water management systems, inhibiting water absorption rates and potentially exacerbating erosion (Bearden & Petersen, 2004) .

Mining is one of the most important activities in the management of the country's natural resources, contributing significantly to national per capita income and economic development (Ericsson & Löf, 2019) . However, this activity also brings serious negative impacts, such as environmental damage, which often outweigh the benefits. In Indonesia, mining, especially in tin-producing areas such as Bangka

Belitung, causes severe environmental degradation. This can be seen from the extensive land damage caused by mining that is not followed by adequate reclamation, resulting in ecosystem changes, loss of nutrients, and damage to marine ecosystems, which play an important role in maintaining the balance of nature. Environmental damage caused by tin mining activities in Belitung Regency requires serious attention, because it not only damages the physical condition of the land but also has an impact on vital ecological functions such as marine ecosystem protection, weather control, and biodiversity.

In addition, Indonesia's legal system, despite having laws governing reclamation and post-mining, such as Law No. 32/2009 on Environmental Protection and Management and the Mining Law, has not been fully effective in addressing post-mining environmental issues. The reclamation process, which should be part of the social responsibility of companies and the government, is often hampered by a lack of strict supervision, administrative problems and the inability to implement policies effectively. There is also limited community participation in the reclamation process, given the dominance of elites who exploit this potential for personal gain. Thus, although Indonesia has policies that are oriented towards sustainability and environmental protection, there are still many challenges to be faced in their implementation.

On the other hand, China, as the world's largest tin producer, also faces similar problems related to post-mining reclamation. The massive exploitation carried out in tin-producing provinces such as Yunnan, Guangxi, and Hunan caused serious environmental damage, such as land degradation, heavy metal contamination, and biodiversity loss. Although China has adopted fairly progressive reclamation policies, such as the Regulation on Land Reclamation (2011) and the Ecological Civilization Construction Plan (2015), the implementation of these policies has encountered various challenges. One of them is the imbalance between economic interests and environmental protection, where local governments tend to prioritize economic revenue over ensuring that reclamation is carried out in accordance with existing provisions. Another problem is the lack of community participation in reclamation planning, which contradicts the principle of procedural justice in environmental law. Technocratic approaches to reclamation, such as the use of high technology for monitoring and restoration, while effective in some cases, ignore the social and cultural dimensions, especially for indigenous communities who depend on the degraded land. One example of the failure of reclamation policies in China is the use of reclaimed land that should have been returned to ecosystems, instead being converted for commercial infrastructure projects (Ni et al., 2023) .

Although China has created policies that integrate technology and fiscal incentives to support more sustainable reclamation, there is criticism regarding the inequitable distribution of environmental benefits. China's environmental liability insurance system is unable to guarantee protection for communities around mines who continue to suffer health impacts from unaddressed heavy metal pollution (Shi et al., 2023) . The ecological justice perspective here provides an understanding that despite efforts to improve environmental conditions through technology and regulation, there are still large inequalities in the distribution of environmental burdens and benefits, especially for the most vulnerable groups.

China and Indonesia's post-tin mining reclamation policies share a common philosophical foundation, namely the principles of sustainability and equity, with a focus on social and ecological responsibility. In both countries, reclamation is not just about physically restoring land that has been damaged, but also about restoring ecosystems that have been destroyed and ensuring that natural resources are used wisely and sustainably. However, while both countries adopt similar principles, there are major differences in implementation. In Indonesia, weaknesses in supervision and community participation have led to the failure to effectively implement reclamation. In contrast, in China, despite the integration of advanced technology, issues of inequality in public access to the reclamation planning process and conflicts of interest between the center and regions remain major obstacles.

The importance of a comparative study between post-tin mining reclamation policies in Indonesia and China is to understand how both countries face similar challenges in post-mining environmental management, and to explore more effective and equitable solutions. While the two countries' policies have similar philosophical underpinnings, their different approaches to implementation demonstrate the importance of collaboration in developing more holistic reclamation policies that integrate technology, community participation and the protection of environmental rights, particularly for directly affected communities. By understanding the strengths and weaknesses of each

system, Indonesia and China can learn from each other and adapt better approaches to achieve more effective and equitable sustainability goals.

RESEARCH METHOD

In writing, a writing methodology is required. Method concerns the problem of how to work to understand the object that is the target of the science in question. So that the results of writing can be scientifically justified, a certain writing methodology is needed. Research methods are scientific activities related to analysis and construction, which are carried out methodologically, systematically and consistently. Methodological means according to a certain method or method, systematic means based on a system, and consistent means the absence of conflicting things within a certain framework. The approach method used in this research is a normative juridical approach, namely research that emphasizes research that emphasizes the rules that exist in positive law (Ningsih, 2019).

ANALYSIS AND DISCUSSION

THE REALITY OF TIN MINING IN INDONESIA AND CHINA

Despite having different perspectives on production, mining methods, environmental impacts, and management regulations, the tin mining industry in Indonesia and China greatly affects the international economy. Leading tin producer Indonesia has many tin reserves, especially in Bangka Belitung province. Based on mostly small-scale mines that often operate irregularly, tin production in Indonesia is estimated to be around 80,000 tons by 2023 (Sulista & Rosyid, 2022) . Using traditional methods with crude tools, this mining damages the environment, including terrestrial and aquatic ecosystems and pollutes soil and water. In addition, occupational safety in artisanal mining is usually a big issue as most workers do not have sufficient registration or legal protection. Although the Indonesian government has made efforts to enforce stricter rules regarding environmental and safety impacts, enforcement against illegal activities remains a major problem as many miners still operate without the necessary licenses or controls.

On the other hand, China has a significant impact on the world tin market even though its tin reserves are only 70,000 tons, less than that of Indonesia. China gives top priority to tin processing as well as the use of advanced technology in mining projects. Most tin mining in China is done by large companies that use more environmentally friendly underground mining methods. Although China can reduce the negative impact of the mining industry by using modern technology, land and water pollution remains a problem. In addition, the Chinese government is enforcing stricter mining rules and better management practices to improve worker safety and industry sustainability. Although the tin mining sector in China faces sustainability challenges, significant efforts have been made to minimize environmental damage and implement more environmentally friendly regulations (Yang et al., 2018) .

Tin mining in Indonesia has emerged as a significant industrial sector, as Indonesia is one of the world's largest tin producers. Nonetheless, despite the sizable economic contribution of the sector, tin mining raises many issues with environmental and social impacts. In this context, it is important to examine the impacts of tin mining in Indonesia on environmental conditions and the function of environmental laws and regulations in mitigating these impacts.

Tin extraction in Indonesia is mostly done through two main methods: land mining and sea mining. Land mining generally occurs in the Bangka Belitung region, while sea mining generally occurs in the waters around tin-producing islands. Both methods have significant environmental impacts. Land-based mining often causes damage to adjacent land and ecosystems, resulting in deforestation, water pollution and decreased biodiversity. Meanwhile, marine mining, although considered more efficient, causes damage to coral reefs and marine ecosystems, including sedimentation that can disturb marine biota (Sulista & Rosyid, 2022) .

From an environmental theory perspective, the adverse impacts of tin mining can be examined through environmental features, which include aspects such as water, soil, air quality and ecosystems (Kusin et al., 2020) . Tin mining often ignores the idea of sustainable development, which seeks to meet the needs of the current generation without jeopardizing the ability of future generations to meet their own needs. A significant impact is water pollution resulting from the discharge of mining waste containing hazardous compounds, such as mercury, which is often used in tin processing. Mercury spilled

into the environment can contaminate aquatic ecosystems and poison the species within them, ultimately jeopardizing the health of humans who consume polluted fish or water. In addition, tin mining in Indonesia often occurs in areas that do not have clear licenses or legal status, leading to unsustainable natural resource management issues. Although the government has implemented regulations regarding tin mining, illegal mining activities still continue, especially in areas that lack supervision. This illegal mining increases environmental degradation and ignores the principles of effective natural resource management.

Indonesia has various legal provisions designed to oversee environmental management, including those relating to tin mining. Law No. 4/2009 on Mineral and Coal Mining is an important legislative framework that regulates mining operations, particularly tin extraction. The law mandates that all mining companies have valid mining licenses and requires them to improve and preserve the environment after mining activities end. In practice, oversight of the implementation of this law is often inadequate, especially in relation to the management of illegal mining which is difficult to regulate.

Furthermore, Law No. 32/2009 on Environmental Protection and Management is a very important legal framework for regulating the environmental impacts of mining operations. This law mandates that companies must conduct an environmental impact assessment (AMDAL) before starting mining operations. In practice, however, mining companies often ignore EIA procedures or bribe relevant officials to obtain permits in violation of the law. This is a major challenge in establishing sustainable mining management practices. The rules of environmental law that also apply in Indonesia emphasize the importance of the state's role in preserving the environment. The state is expected not only to function as a watchdog, but also to actively promote sustainable mining practices. Therefore, in tin mining, the state must ensure that mining operations conducted by companies adhere to strict and acceptable environmental criteria.

Mining operations include a series of processes starting with general investigation, exploration, and feasibility studies, followed by construction, mining (including processing and refining), transportation, and sales, and ending with post-mining land recovery. Meanwhile, mining management is an effort made both technically and non-technically so that mining activities do not cause problems, both for the mining activities themselves and for the environment. The current mining law that regulates mining activities is Law Number 4 of 2009. This law regulates mining activities in the mineral and coal industry.

Meanwhile, other mining sectors are regulated under Law No. 22/2001 on oil and gas, emphasizing that the mining sector is an economic activity that not only produces mining products, but also causes damage to land and ecosystems. The idea of green mining aims to establish harmonious interactions between mining companies, communities and the environment (Ming-yin et al., 2009) . However, as articulated by Dong-sheng et al. (Dong-sheng et al., 2009) , it is challenging to choose between resource development and ecological conservation. It is important to identify methods to reconcile the differences between theoretical frameworks and practical events. This reclamation work is exclusively required for mining companies. According to Government Regulation No. 76/2008 on Forest Rehabilitation and Reclamation, all mining companies must revegetate key post-mining areas. Warhurst et al. (Warhurst & Mitchell, 2000) define Corporate Social Responsibility (CSR) as a company's obligation to internalize environmental and social impacts by reducing adverse social impacts and proactively managing pollution, thereby minimizing negative operational impacts and enhancing positive outcomes.

Post-mining environmental programs are designed to mitigate and reduce the damage caused by mining activities. Si et al. (Si et al., 2010) identified the following parameters to assess the environmental impact of mining activities including Ecosystem Protection of natural resources, Financial benefits, Social benefits and Sustainability of mining activities. The main authority for granting mining licenses in Indonesia is the Ministry of Energy and Mineral Resources (ESDM) as the central government body. MEMR has exclusive authority to grant Special Mining Business License (IUPK) for special mining business license areas (WIUPK), which include production operations that cross provincial or international borders. The Ministry of Energy and Mineral Resources oversees national mining service company licenses (IUJP) and is tasked with assessing and canceling problematic mining licenses, including those that overlap with other concession areas or contradict legal regulations. The Ministry of Energy and Mineral Resources has jurisdiction to issue mining permits for activities that span multiple provinces or involve transportation and sales between provinces or countries.

Governors have the authority to issue IUPs for specific areas within a province, including limited transportation and sales regulations within those areas. The governor is responsible for approving the Work Plan and Budget (RKAB) for production operation IUPs within his jurisdiction. The central government allocates certain jurisdictions to the Investment Coordinating Board (BKPM) through Ministerial Regulation No. 25/2015. BKPM has the authority to grant IUP to foreign investment companies (PMA), which includes licenses for exploration, production, processing/refining, and transportation and sales.

COMPARISON OF POST-LIMESTONE RECLAMATION POLICIES

In general, the basis for the regulation and policy of mining or excavation material management is Article 33 paragraph (3) of the 1945 Constitution and Law Number 3 of 2020. Article 33 paragraph 3 of the 1945 Constitution states "The land, water and natural resources contained therein are controlled by the state and used for the greatest prosperity of the people". The use of Article 33 paragraph 3 is carried out with the assumption that natural resources are controlled by the state and are common property, in this case national, and are used for the welfare and maximum benefit of the people's prosperity from one generation to the next in a sustainable manner (sustainability principle). Mining excavation materials are unrenewable natural resources and their management and utilization require a spatial management approach that is handled holistically and integratively by taking into account four main issues, namely: growth, equity, environment, and conservation.

Reclamation activities are a mandatory program that must be carried out by every company, which is regulated in Article 39 paragraph 1 letter K of Law No. 3 of 2020 concerning Mineral and Manganese Mining. Management and monitoring of the mining environment including Post-Mining Reclamation activities must be carried out by the government at the IUP and IUPK locations for the implementation of good mining techniques. Post-mining activities, hereinafter referred to as Post-mining, are planned, systematic, and continuous activities after part or all of the Mining Business activities to restore natural environmental functions and social functions according to local conditions throughout the Mining area.

PT Timah Tbk (PT Timah) Belitung Regency targets to reclaim 396.5 hectares (ha) of ex-mining land by 2024.By 2024, PT Timah plans to reclaim 396.5 hectares of ex-mining land. In 2023, the state-owned tin company has reclaimed 26.5 hectares in Belitung Regency, 68 hectares in East Belitung Regency and 91 hectares in Cross Regency. (Head of Corporate Communications of PT Timah Tbk, Anggi Siahaan, June 20, 2024). The company is committed to conducting sustainable environmental management and also providing added value to the community. Sustainable environmental management is one of the company's priorities. So that the reclamation program carried out is not only limited to carrying out responsibilities but also has an economic impact on the community. PT Timah in carrying out coastal and marine reclamation involves local communities so that it can have an economic impact on the surrounding community. (Head of Corporate Communications of PT Timah Tbk, Anggi Siahaan, June 20, 2024).

Sustainable environmental management is PT Timah's commitment in carrying out the company's business processes. Post-mining reclamation is part of the environmental management program. In 2015-2023, PT Timah has carried out land reclamation covering an area of 3,166.37 ha in Bangka Belitung Islands Province. While for 2024, PT Timah plans to reclaim 396.5 ha of ex-mining land. The form of reclamation carried out is with Revegetation Reclamation such as fast growing plants, fruit plants and oil palm plants on the coast. The reclamation program carried out by PT Timah has benefited the community, with becoming a tourist attraction at Kampoeng Reklamasi Air Jangkang and Kampoeng Reklamasi Selinsing in Belitung Regency has become a joint tourist destination.

The marine reclamation carried out by PT Timah between 2016-2023 is the sinking of fish shelters of 3,105 units or 66.16 ha, coral reef transplantation of 1,475 units or 51.10 ha, Artificial Reef 5,760 units or 96 ha, Installation of Abrasion Barriers along 2,360 meters, Mangrove Planting covering 8.81 ha, Restocking Squid 40,435 heads and Restocking Crabs 2,400 heads. In addition to reclamation, PT Timah is also involved in supporting environmental management programs carried out with the Belitung Regional Government, stakeholders as well as the Ministry of Marine Affairs and Fisheries and the Environmental Service. Environmental management activities carried out include mangrove planting, planting productive trees and also reforestation. The policy of the ESDM Belitung Regional Government

with the prevention of tin mine pollution is an action to prevent the entry or inclusion of living things, energy substances, and/or other components into the environment by human activities so that the quality does not drop to a certain level which causes the environment to be unable to function in accordance with its designation. In the form of, first, remediation, which is an activity to clean the surface of polluted soil. There are two types of soil remediation, namely in-situ (or on-site) and ex-situ (or off-site) (Chen et al., 2015) . On-site cleanup is cleanup at the site.

This cleanup is cheaper and easier, consisting of cleaning, venting (injection), and bioremediation. Off-site cleanup involves excavating the contaminated soil and transporting it to a safe area. Once in the safe area, the soil is cleaned of contaminants. To do this, the soil is stored in an impermeable basin/tank, and the cleaning agent is pumped into the basin/tank. Next, the contaminants are pumped out of the tanks which are then treated with a wastewater treatment plant. This off-site cleanup is much more expensive and complicated. Second, bioremediation, which is the process of cleaning up soil pollution using microorganisms (fungi, bacteria). Bioremediation aims to break down or degrade contaminants into less toxic or non-toxic materials (carbon dioxide and water). Third, the use of tools (retort-amalgam) in gold spinning needs to be done in order to reduce Hg pollution. Fourth, there is a need for Environmental Management Efforts and Environmental Monitoring Efforts or Environmental Impact Assessment (AMDAL) studies in formulating policies related to mining activities. Before implementation, mining activities can be estimated in advance of their impact on the environment. This study must be implemented, supervised and monitored properly and continuously, not just a formality of administrative needs. Fifth, counseling to the community about the dangers of tin mining needs to be done. For health workers, there needs to be training on surveys and public health risks due to mining pollution in tin mining areas.

Mining excavation materials are unrenewable natural resources and their management and utilization require a spatial management approach that is handled holistically and integratively by paying attention to four main issues, namely: growth, equity, environment, and conservation (Domínguez et al., 2019) . The success of the policy is achieved if there are no violations while it is said to be unsuccessful if the policy objectives are not achieved. Policy failure is often because the policy cannot be implemented. The implementation process is mostly left to government agencies at various levels, both provincial and district levels. Each level of implementation still requires further policy formation in various forms of legislation to provide further elaboration. Therefore, to be able to respond to a policy more effectively, it is necessary to have stages that must be passed, both regarding the planning and implementation stages. In addition, in order to realize the plan of a program, the role of resources is the main element that is very decisive.

There are several factors that influence policy implementation in mangrove forest conservation efforts, namely first, communication, how to inform as easily as possible can be understood by the target community the intent and purpose of the policies taken. Second, the bureaucratic structure, which is supported by implementing institutions that are straightforward and simple. Third, resources, namely the availability of sources of funds, power and facilities in the form of sufficient facilities and infrastructure, and fourth, disposition factors as the attitude of implementers to implement policies that have an important role in policy implementation, because no matter how clear and consistent the provisions or rules of a policy, it needs to be supported by a responsible attitude and guidance (Fuentes-George, 2017) .

Efforts to accelerate implementation have been made by the government, including through the establishment of the Peat and Mangrove Restoration Agency (BRGM). BRGM together with KLHK, KKP, as well as mining license holders are obliged to carry out mangrove rehabilitation, as well as business world CSR. Other efforts are through applied research and studies, as well as the construction of modern nurseries and the World Mangrove Center. Furthermore, it is necessary to review all mangrove-related policies or can link mangroves such as settlement policies and industrial policies including village funds. The institutional system and legal instruments, namely the Forestry Service, the Environment Service and the Marine and Fisheries Service, are very competent institutions in mangrove management. Coordination between agencies related to mangrove management is urgent at this time. Aspects of legal instruments are regulations and laws related to mangrove management. Related policies in mangrove management, what is needed is law enforcement for violations of the rules (Huang et al., 2022) . According to Soerjono Soekanto, there are 5 (five) factors of legal effectiveness, namely: a. The legal

factor itself, which in this theory is limited to laws only; b. Law enforcement factors, namely the parties who form and apply the law; c. Factors of facilities and facilities that support law enforcement; d. Community factors, namely the environment in which the law is enforced. Community factors, namely the environment where the law applies or is applied; e. Cultural factors, namely regarding the results of work, creation, and taste based on human nature in the association of life.

China's post-tin mining reclamation policy has been an integral part of the country's efforts to manage the environmental impacts of mining activities, given that it is one of the world's largest tin producing countries. Intensive mining activities in China have led to various environmental problems, including land degradation, water pollution and ecosystem damage. Therefore, the Chinese government has developed various policies to mitigate the negative impacts of tin mining, with the main focus on post-mining land reclamation and rehabilitation. The Chinese government has issued a series of regulations governing the means and methods of reclamation that mining companies must implement. One of the main regulations underlying this policy is the Environmental Protection Law and Mining Law which require companies to make clear and detailed reclamation plans before starting mining activities (Cao, 2007) . The government also requires companies to provide adequate reclamation funds, which must be included in the company's budget before mining activities begin. This aims to ensure that companies are environmentally responsible, even after mining activities are completed. In addition, companies are also required to restore degraded land in an environmentally friendly manner and in accordance with standards set by the government.

China applies a high-tech approach to implementing post-mining reclamation. The use of advanced technology in reclamation is one of the hallmarks of China's reclamation policy. Mining companies in China have adopted soil engineering technologies that enable the restoration of soil damaged by mining activities (Feng et al., 2023) . These technologies include the use of additives to improve the structure of polluted or degraded soils, allowing them to become fertile again and support vegetation growth. In addition, digital mapping and geographic information system (GIS) technologies are used to monitor degraded land and plan reclamation more effectively. Using GIS, companies can map the areas most in need of rehabilitation and monitor the progress of reclamation in real-time.

In some reclamation projects, especially in heavily degraded mining areas, China is adopting *hydroseeding* or spray seed dispersal techniques that allow seeds to grow more quickly and effectively on degraded land (Li et al., 2022) . The seeds used are usually selected based on their ability to grow well in the degraded soil, and in some cases, the crops planted are also selected for economic purposes, such as tea or ginseng plants, which can provide additional economic benefits to local communities. This not only helps the ecosystem recover, but also improves the quality of life for the community by providing new sources of income. The Chinese government strives to ensure that reclamation programs not only benefit mining companies, but also provide direct benefits to local communities. One way it does this is by involving communities in reclamation activities, either through training or providing economic incentives for those who participate in land rehabilitation. In some areas, communities are involved in tree planting, plant maintenance and management of completed reclamation areas. In addition, mining companies are also required to provide jobs to local communities as part of their corporate social responsibility. This program not only creates new jobs, but also helps raise community awareness about the importance of environmental conservation.

One of the biggest challenges is the management of mine waste, which often contains hazardous materials such as heavy metals and chemicals that can contaminate soil and water. Although China has implemented strict regulations for managing mine waste, some companies still face difficulties in effectively managing the waste, which can hamper the reclamation process. High reclamation costs are also a major challenge in implementing this policy. Although the Chinese government provides funds and incentives to assist companies with reclamation, many mining companies, especially smaller ones, struggle to meet financial obligations related to reclamation. To address this issue, some mining companies in China are working with financial institutions and the government to secure sufficient financing. Many local communities are now more involved in reclamation and environmental conservation programs, thanks to educational efforts by the government and mining companies. These programs aim to change the paradigm of communities from focusing on the direct economic benefits of mining to caring more about environmental sustainability and the sustainability of natural resources.

Lawrance M. Friedman argues that the effectiveness and success or failure of law enforcement depends on three elements of the legal system, namely the legal structure (structure of law), legal substance (substance of the law) and legal culture (legal cultere). Legal structure concerns law enforcement officials, legal substance includes legislation and legal culture is a living law adopted in a society (Pontin & Vaughan, 2018) . Policy is a means for the government to implement the provisions of higher laws and regulations. Government policies in implementing legislation can be outlined in the form of Government Regulations, Presidential Regulations, Ministerial Regulations issued by the central government and in the form of Regional Regulations and Regional Head Decrees made by local governments.

CONCLUSION

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REFERENCES

[1] *Bearden, B. N., & Petersen, L. M. (2004). Influence of arbuscular mycorrhizal fungi on soil structure and aggregate stability of a vertisol. Plant and Soil, 218, 173–183.*

[2] *Cao, X. (2007). Regulating mine land reclamation in developing countries: The case of China. Land Use Policy, 24(2), 472–483. https://doi.org/10.1016/j.landusepol.2006.07.002*

[3] *Chamid, C., Sulistijo, B., Kusumo, A., & Fhadila, O. (2020). Engineering concept for reclamation on land use of abandoned alluvial tin mine as a solution to achieve sustainable post-mining. IOP Conference Series: Materials Science and Engineering, 830. https://doi.org/10.1088/1757-899X/830/3/032070*

[4] *Chen, S.-S., Xu, J.-H., & Fan, Y. (2015). Evaluating the effect of coal mine safety supervision system policy in China's coal mining industry: A two-phase analysis. Resources Policy, 46, 12–21. https://doi.org/10.1016/j.resourpol.2015.07.004*

[5] *Domínguez, C. R., Martínez, I. V., Piñón Peña, P. M., & Rodríguez Ochoa, A. (2019). Analysis and evaluation of risks in underground mining using the decision matrix risk-assessment (DMRA) technique, in Guanajuato, Mexico. Journal of Sustainable Mining, 18(1), 52–59. https://doi.org/10.1016/j.jsm.2019.01.001*

[6] *Dong-sheng, Z., Gang-wei, F., Li-qiang, M., An, W., & Yu-de, L. (2009). Harmony of large-scale underground mining and surface ecological environment protection in desert district—A case study in Shendong mining area, northwest of China. Special Issue Title: Proceedings of the International Conference on Mining Science & Technology (ICMST2009), 1(1), 1114–1120. https://doi.org/10.1016/j.proeps.2009.09.171*

[7] *Ericsson, M., & Löf, O. (2019). Mining's contribution to national economies between 1996 and 2016. Mineral Economics, 32, 223–250. https://doi.org/10.1007/s13563-019-00191-6*

[8] *Feng, Z., Hu, Z., Zhang, X., Zhang, Y., Cui, R., & Lu, L. (2023). Integrated Mining and Reclamation Practices Enhance Sustainable Land Use: A Case Study in Huainan Coalfield, China. Land, 12(11). https://doi.org/10.3390/land12111994*

[9] *Fuentes-George, K. (2017). Consensus, Certainty, and Catastrophe: Discourse, Governance, and Ocean Iron Fertilization. Global Environmental Politics, 17(2), 125–143. https://doi.org/10.1162/GLEP_a_00404*

[10] *Haryadi, D., Ibrahim, I., & Darwance, D. (2023). ECOLOGICAL IDEALISM IN THE REGULATION OF TIN MINING IN BANGKA BELITUNG: REASONING ABOUT CRUCIAL ARTICLES. Journal of Sustainability Science and Management, 18(9), 17–37. Scopus. https://doi.org/10.46754/jssm.2023.09.003*

[11] *Huang, L., Liu, Y., Ferreira, J. F. S., Wang, M., Na, J., Huang, J., & Liang, Z. (2022). Long-term combined effects of tillage and rice cultivation with phosphogypsum or farmyard manure on the concentration of salts, minerals, and heavy metals of saline-sodic paddy fields in Northeast China. Soil and Tillage Research, 215, 105222. https://doi.org/10.1016/j.still.2021.105222*

[12] *Ibrahim, Haryadi, Dwi, & Wahyudin, Nanang. (2018). The Social Dilemma of Tin Mining of Non-miners People: A Comparative Study Between Bangka and Belitung People's Perception. E3S Web Conf., 73, 02014. https://doi.org/10.1051/e3sconf/20187302014*

[13] *Kusin, F., Sulong, N., Affandi, F., Molahid, V., & Jusop, S. (2020). Prospect of abandoned metal mining sites from a hydrogeochemical perspective. Environmental Science and Pollution Research, 28, 2678–2695. https://doi.org/10.1007/s11356-020-10626-1*

[14] *Li, G., Hu, Z., Yuan, D., Li, P., Feng, Z., He, Y., & Wang, W. (2022). A new approach to increased land reclamation rate in a coal mining subsidence area: A case-study of Guqiao Coal Mine, China. Land Degradation & Development, 33(6), 866–880. https://doi.org/10.1002/ldr.4184*

[15] *Ming-yin, L., Zhen-fang, Z., Xing, M., & Dai, L. (2009). Study on incentive mechanisms of coal green mining. Special Issue Title: Proceedings of the International Conference on Mining Science & Technology (ICMST2009), 1(1), 211–218. https://doi.org/10.1016/j.proeps.2009.09.035*

[16] *Ni, P., Pan, J.-Y., Han, L., Cui, J.-M., Gao, Y., Fan, M.-S., Li, W.-S., Chi, Z., Zhang, K.-H., Cheng, Z.-L., & Liu, Y.-P. (2023). Tungsten and tin deposits in South China: Temporal and spatial distribution, metallogenic models and prospecting directions. Ore Geology Reviews, 157, 105453. https://doi.org/10.1016/j.oregeorev.2023.105453*

[17] *Ningsih, A. S. (2019). The Doctrine of Product Liability and Negligence Cannot Be Applied to Malware-Embedded Software. Journal of Indonesian Legal Studies, 4(1), 7–20. https://doi.org/10.15294/jils.v4i01.29157*

[18] *Oyarzo, M., & Paredes, D. (2019). Revisiting the link between resource windfalls and subnational crowding out for local mining economies in Chile. Resources Policy, 64, 101523. https://doi.org/10.1016/j.resourpol.2019.101523*

[19] *Pontin, B., & Vaughan, S. (2018). Environmental Law: A Very Short Introduction. By ELIZABETH FISHER. Journal of Environmental Law, 30(1), 174–177. https://doi.org/10.1093/jel/eqy005*

[20] *Rousseaux, P., Gremy-Gros, C., Bonnin, M., Henriel-Ricordel, C., Bernard, P., Floury, L., Staigre, G., & Vincent, P. (2017). "Eco-tool-seeker": A new and unique business guide for choosing ecodesign tools. Journal of Cleaner Production, 151, 546–577. https://doi.org/10.1016/j.jclepro.2017.03.089*

[21] *Shi, B., Jiang, L., Bao, R., Zhang, Z., & Kang, Y. (2023). The impact of insurance on pollution emissions: Evidence from China's environmental pollution liability insurance. Economic Modelling, 121, 106229. https://doi.org/10.1016/j.econmod.2023.106229*

[22] *Si, H., Bi, H., Li, X., & Yang, C. (2010). Environmental evaluation for sustainable development of coal mining in Qijiang, Western China. International Journal of Coal Geology, 81(3), 163–168. https://doi.org/10.1016/j.coal.2009.11.004*

[23] *Sulista, S., & Rosyid, F. A. (2022). "The economic impact of tin mining in Indonesia during an era of decentralisation, 2001–2015: A case study of Kepulauan Bangka Belitung Province." The Extractive Industries and Society, 10, 101069. https://doi.org/10.1016/j.exis.2022.101069*

[24] *Ullah, S., Ahmad, K., Sajjad, R. U., Abbasi, A. M., Nazeer, A., & Tahir, A. A. (2019). Analysis and simulation of land cover changes and their impacts on land surface temperature in a lower Himalayan region. Journal of Environmental Management, 245, 348–357. https://doi.org/10.1016/j.jenvman.2019.05.063*

[25] *Warhurst, A., & Mitchell, P. (2000). Corporate social responsibility and the case of Summitville mine. Resources Policy, 26(2), 91–102. https://doi.org/10.1016/S0301-4207(00)00019-2*

[26] *Yang, C., Tan, Q., Zeng, X., Zhang, Y., Wang, Z., & Li, J. (2018). Measuring the sustainability of tin in China. Science of The Total Environment, 635, 1351–1359. https://doi.org/10.1016/j.scitotenv.2018.04.073*