

Socio-Economic Impacts and Sustainability of Mining, a Case Study of the Historical Tin Mining in Singkep Island-Indonesia

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Abstract

The socio-economic impacts of past mining were studied at Singkep Island, Indonesia. Tin mining was the only major industry on the island from 1812-1992. It contributed around 65% -90% of the local economy, provided 2452 out of 8716 direct jobs, operated 2 out of 39 primary schools, built infrastructure and controlled the hospital, airport, power plant and piped water. After closure, substantial mining benefits turned very quickly into long-term losses. Job opportunities became unemployment, economic contributions became economic collapse, and infrastructure assets became liabilities. Environmental degradation was a negative impact during and after mining. Education was relatively unaffected because most children attended state schools. Poor resource governance during active mining led the island to heavy economic dependence, little economic diversification, and failed to transform the finite natural resources to human capital. These findings challenge the claim that Indonesia has successfully released itself from the resource curse that prevailed in the 1970s-1990s. Most previous research on Indonesia carried out analyses at national scale, while the case of Singkep emphasises the importance of regional studies.

Keywords: socio-economic impacts; sustainable mining; resource governance; mining regions; Singkep Island.

1. Introduction

Indonesia's national economic growth during the 1970s to 1990s provides evidence that the country is one of the few resource-rich countries capable of employing mineral wealth to support strong and sustainable economic growth, thus successfully escaping the resource curse trap (Auty, 2006; Birdsall et al., 2001; Mikesell, 1997; Rosser, 2007). In reality, whilst mining may have supported economic growth at the national level, the story at the regional level is different. Today, local communities are still suffering from the negative impacts of mining activities. Contrary to the general belief that Indonesia has escaped the natural resource curse, this case study illustrates that at the regional level, the consequences of the resource curse are deeply rooted in the post-mining communities. There has been limited assessment of the impact of mine closure on the local communities in Indonesia. This paper aims to bridge the current gap in research and challenge the belief that Indonesia was able to escape the resource curse.

This study examines the impact of historical tin mining on Singkep Island in Indonesia, which started in 1812 and ended in 1992. We assess the main socio-economic changes before and after the mine closed, and analyse the factors that influenced the changes and the challenges to sustainable mining and sustainable development within the case study area. This research focuses on the years from 1970 to 2018. By focusing on this period, the research offers an up-to-date insight on the case study and addresses the lack of recent literature on tin mining on Singkep, and elsewhere in Indonesia.

2. Sudden Mine Termination and Unplanned Closure

Mine closure has the potential for severe negative impacts, especially on communities that are socio-economically dependent on the mining industry (Neil et al., 1992; Stacey et al., 2010). It raises concerns about the management of the environment, unemployment, and the sustainability of social services and economic development. Mine closure planning and implementation must, therefore, be integrated with the mining lifecycle from the early stages of the project. However, many mines undergo sudden and unplanned closure owing to factors such as economic, environmental, and/or social and political pressures (Evans, 2011; Laurence, 2006; Limpitlaw & Hoadley, 2006).

Tin mining on Singkep Island was subject to a sudden unplanned closure in 1992. The global tin price declined from approximately USD16 500 in 1980 to USD5 500 per ton in mid-1991. The company failed to survive the price fluctuations and had to close. The historical reliance on mining hindered the miners from implementing mitigation measures to protect their operations. As the cessation was unexpected for the company, communities and the governments, there was almost no planned mine closure strategy. Mine closure was a business survival decision, with little preparation and few measures for the transition.

The unplanned and sudden mine closure instantly generated effects identical to the withdrawal of significant support from the local economy. The former miners had not prepared adequate skills and knowledge to start other jobs or establish their own

businesses. The community lost its main economic generator and was without alternative resources, which worsened the condition and enhanced the social pressure. The sudden termination owing to the financial problems also left the abandoned mine voids without rehabilitation, and this caused the community to lose potential land for farming or other economic sectors.

The regional government did not expect to receive the hand-over of the company's assets, such as the hospital, airport, power plant, water supply and buildings, and thus, they did not prepare. They were lacking budget allocation, human resources, managerial capability and other aspects needed to manage civic assets. The sudden and unplanned termination caused the corporate assets obtained from the mining profits to turn into civic liabilities.

Neil et al. (1992) and Van Zyl et al. (2002) confirm that sudden and unplanned termination of mining projects results in impacts that cause the local community concern. The worst impacts occur if the closure results from financial failure resulting, for instance, from declining metal price, as this negatively affects many people's livelihoods, not to mention the challenges of environmental degradation, which eventually worsen the socio-economic misery (Van Zyl et al., 2002).

3. Study Area: Singkep as a Tin Island

Singkep has a long history in tin mining and, along with Bangka and Belitung islands, was once known worldwide as a tin mining producer (Kaur & Diehl, 1996) (Figure 1). The discoveries of tin deposits in this tropical region during the mid-19th century led these islands to surpass Cornwall in England as the world's largest tin

producer at that time (BHP, 2018, 07 November). Tin mining on Singkep Island began when the family of Sultan Lingga, who controlled Singkep Island, discovered tin on Singkep around 1812 (Mukana, 1976). In 1890, Singkep Tin Maatschappij, a private Dutch mining company, obtained a concession from the Sultan of Lingga to exploit the tin deposit (Kaur & Diehl, 1996). In 1934, N.V. Singkep TIN Exploitatie Maatschappij, a subsidiary of Gemeenschappelijke Mijnbouw Maatschappij Billiton, took over the tin exploitation until 1959, which marked sixty-six years total period of tin exploitation by the Dutch enterprises. From then the tin mining operations were controlled by the Indonesian state-owned mining company for 33 years from 1959 until its closure in 1992. From 1968 to 1992, Singkep Tin Mining Unit (UPTS), a subsidiary of PT Tambang Timah, the state-owned tin mining company, carried out the mining. Currently, the tin resources in Singkep have been significantly depleted, and the remaining on-shore deposit is unlikely to be economically profitable for new investment. However, the tin mines in Bangka and Belitung are still operating today.

Table 1. Bangka, Belitung, and Singkep Tin Production 1981-1988 (in quintal Sn)

Year	Bangka	Belitung	Singkep
1981	119 791	82 720	11 350
1982	129 791	78 594	12 500
1983	169 197	82 242	15 065
1984	148 122	94 923	22 000
1985	163 541	92 449	16 350
1986	192 973	87 825	29 005
1987	185 974	91 912	33 060
1988	202 728	81 020	1 375

Quintal is equivalent to 100 kg. Sn is Tin chemical element symbol (Latin: Stannum)
Source: PT Tambang Timah (Persero) (1988)

Although tin production on Singkep Island was always much smaller than at the two main tin-producing islands of Bangka and Belitung in Indonesia (Table 1), tin mining was the only major industry and the largest employer on the island. During the mid-1960s to early 1970s, tin mining was the direct and indirect source of income for approximately 75% of around 24 000 of Singkep's population (Mukana, 1976). In 1992, there were about 2,425 direct employees, more than 28% of the total workers in the island (Statistics Officer of Singkep District, 1993). In the past, Singkep Island was all one administrative district, but it is now split into four separate administrative areas including Singkep, West Singkep, South Singkep, and Coastal Singkep.

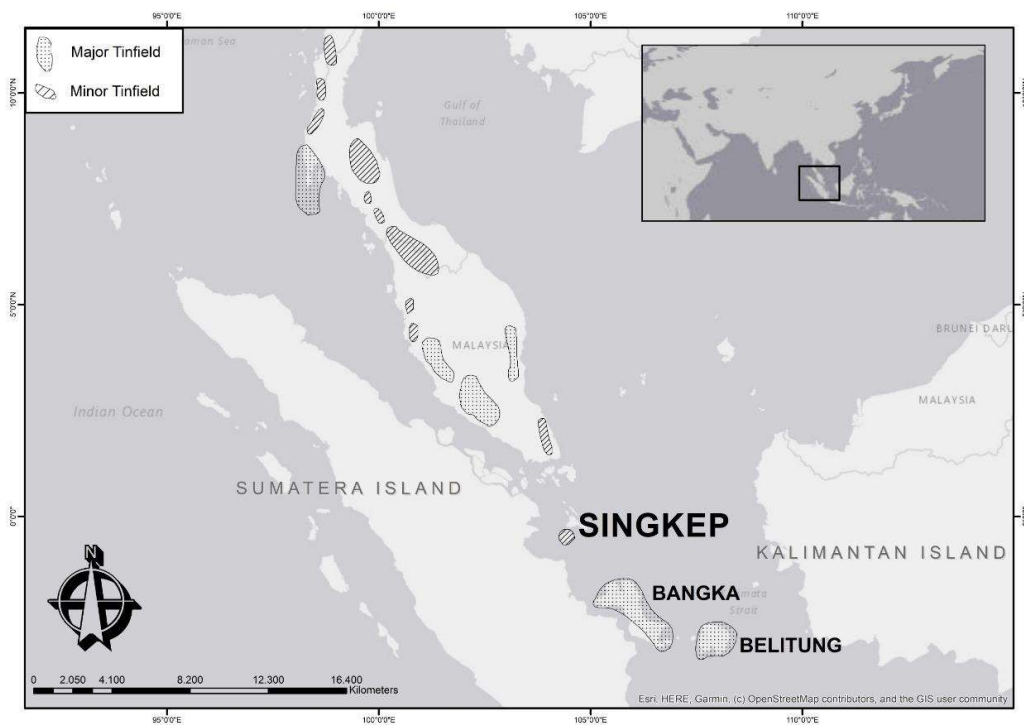


Figure 1. Tin producer islands in Indonesia and Malaysia. Source: Kaur and Diehl (1996)

4. Setting the context for the results: socio-economics and sustainability in the mining industry

4.1. Mining Governance and Resource Curse

Governance is a broad terminology but generally refers to changes in the nature and role of the state in the shifting of the hierarchical bureaucracy towards the use of more extensive networks in providing public services (Bevir, 2008). Governance emphasises interaction between institutions or groups in achieving mutual objectives (Van Kersbergen & Van Waarden, 2004), where the state plays a vital role as the sole owner of required resources to facilitate structural change to achieve sustainable results (Lundqvist, 2018). Mining governance needs to integrate sustainable development principles in the entire mining lifecycle from the initial phases to closure and post-closure (Veiga et al., 2001). This will create more jobs and a more diverse range of jobs, adequately manage environmental and social impacts, optimise the economic linkages, and transform communities to be less dependent on mining (Hobbs, 2005).

However, mineral resource wealth does not always correlate positively with sustainable development (Eggert, 2001). Mining regions may suffer the unsustainable growth associated with the resource curse because of the failure to develop functional minerals governance owing to lack of capability, authority, and competency (Sachs & Warner, 1995). When caught by the resource curse, mineral economies suffer problems such as poor governance, corruption, higher rates of poverty, slower economic growth and social problems. The resource curse can operate at the national level (Sachs & Warner, 1995) and or at the regional level (Paler, 2011) even if a country is benefitting from positive national growth (Fleming & Measham, 2013). The threat of regional resource curse increases with the degree to which regional governments are

fiscally dependent on natural resource wealth (Paler, 2011), and also with the degree of misuse and mismanagement of rents and neglect of education (Kunchu et al., 2016).

4.2. Sustainable Mining and Mine Closure

A key question is how to apply the sustainability concept to mining. All mining operations will halt eventually owing to the extraction of their non-renewable resources. Eggert (2001) claims that mining and minerals seem to be quintessential unsustainable activities, in which individual mines have finite reserves that once mined are gone. Solow (1993) believes that sustainability in mining should be aimed at earnest efforts to preserve productive capacity for the indefinite future, where society as a whole replaces used up non-renewable resources with something else. Mining, however, has the potential to generate economic growth for a country, region and communities at different socio-economic levels through the channels of backwards, forward, final-demand, and fiscal linkages (Radetzki, 1982). Even if a mine itself is not viable, the depletion of the minerals resource can be converted to a sustainable, renewable source of human well-being through appropriate investment in education, healthcare, infrastructure, and alternative economic, which is essential to ensure sustainable income over time (Eggert, 2001).

As there is no single blueprint for sustainable development, many academics and practitioners use their viewpoints to define sustainable development in the context of the mining and minerals industry (Hilson & Basu, 2003). The International Institute for Environment and Development (2002), proposes that the sustainable development framework in mining requires that the sector as *a whole contributes to human welfare*

today without reducing the potential for future generations to do the same. The reference to sustainable mining in this paper is in line with the suggestion of Laurence (2011) that mining investments should be financially profitable, technically appropriate, environmentally sound and socially responsible.

To maintain sustainable development the benefits of mineral extraction should be distributed equally and equitably throughout different levels of the communities and also among the community members regardless of their gender association and access to the benefits. However, many cases show the unequal level of development from the resource sector because local governments are lacking legislative authority and sufficiently well trained human resources to ensure that local communities can benefit from mining (Fleming & Measham, 2013). The local mining employment and spillovers produced in the regional economy also determine mining benefits on income distribution (Fleming & Measham, 2015).

Sustainable mining also means ensuring that mineral benefits extend beyond the mine-life. Mine closure is a vital milestone that has broad consequences, including employment and labour migration, municipal and social services, community cohesiveness, and environment (Haney & Shkaratan, 2003). During, and after, the mine closure phase is the critical test of the contribution to sustainability (Limpitlaw & Hoadley, 2006). Effective closures offer individual and collective stakeholders the opportunity to prepare themselves for the planned closing date; employees may seek alternative work in other regions or companies, and the community can work to ensure mining benefits are sustainable (Laurence, 2006). In contrast, abandoned or

poorly-closed mining can remove essential services such as health, education, piped water and electricity and have permanent negative social and economic impacts on local mining-dependent communities and their environment (Neil et al., 1992).

Because of the importance of post-closure impacts, there is a growing literature that focuses on the topic (Bainton & Holcombe, 2018; Stacey et al., 2010).

Tin mining activities on Singkep were undertaken at a period where best practices and CSR (corporate social responsibility) initiatives were not at the forefront of debates concerning the extractive sector as a whole. By the mid-late 1990s, criticism from civil society and broader public opposition was threatening public acceptance and mining companies started to engage more seriously with initiatives to enhance the sustainability of mining (ICMM, 2020). Initiatives included the Mining, Minerals and Sustainable Development two year consultation project started in 2000, the setting up of the International Council on Mining and Metals in 2001, and the Kimberley Process multilateral trade regime in 2003.

5. Research Methodology

This research employed a combination of quantitative and qualitative methods to offer a holistic picture of the socio-economic impacts of tin mining on Singkep. The quantitative method employed a questionnaire with 27 questions answered by 170 respondents during December 2017-April 2018 and July - November 2018. The questionnaire was checked and approved by the University of Exeter College of Engineering, Mathematics, and Physical Sciences Ethics Committee before use.

At 40 016, the population of Singkep is relatively large (Statistics of Lingga Regency, 2017), making surveying everyone impossible. Additionally, limited roads and local land transport made it difficult to access the population at large. To address these challenges the convenience sampling method was used at social gatherings as an opportunity to access a large sample of the population in one place. On Singkep, it is common for people to gather for informal discussions and / or public leisure in the afternoon. The survey respondents included a range of ages and educational attainments (Table 2).

Table 2. Socio-economic characteristics of the survey respondents

Variable	Frequency	Percentage (%)
Gender		
Male	78	46
Female	92	54
Age		
Under 18	1	1
18-20	10	6
21-30	42	25
31-40	50	29
41-50	36	21
51-60	24	14
61 or above	7	4
Education		
Not completed in primary school	7	4
Primary school (6 yrs)	15	9
Junior high school (3 yrs)	12	7
Senior high school (3 yrs)	46	27
Diploma/Vocational	13	8
Undergraduate	68	40
Master	6	4
Others	3	2

Source: Field survey (2018)

The weakness of convenience sampling is that the opportunity to be involved in the sample is not equal for all individuals in a population. Therefore it usually has

some limitations in the general applicability of the conclusions (Etikan et al., 2016). We further note that based on the age profile of the survey respondents, approximately one-third of them would have had limited or no direct experience of the mine in operation. However, on Singkep, which is a relatively small and remote island, the population is somewhat homogenous in many social-economic aspects, such as ethnicity, language and dialect, religion (Statistics of Lingga Regency, 2017), and especially in terms of the socio-economic issues discussed in the communities. Given these characteristics, it is unlikely that there is any substantial difference in the results from a random sample, a co-operative sample, or a sample gathered in some inaccessible sections of the population.

The qualitative approach in this research involved an in-depth semi-structured interview technique that allows interviewers or interviewees to diverge in pursuing ideas or responses in more detail (Gill et al., 2008). This method can be adapted to a variety of professional, educational, and personal histories of each of the informants, therefore, is constructive in case-study research (Drever, 1995). Such interviews may also provide striking detail and depth information for the oral history, thus, through the elicited memories generated, can help to uncover and reconstruct the past (Keightley, 2010). The seven interviewees in this study included former village spokesmen, former mining employees and a former teacher of the school managed by the mining company. The regent of Lingga and a member of the Board the Lingga Regency Representative from Singkep District were also involved in individual face-to-face interviews. A focus group interview also took place with former mining employees. The selection of the interviewees was due to their experience in the tin

mining operation and their social or cultural location and knowledge of the characteristics of the Singkep Island community. Hence, the narratives elicited are not solely concerned with past mining but with present perspectives on experience and the role of the past in orienting the local communities to particular futures (Keightley, 2010). The surveys and interviews were carried out in the local language, Bahasa Indonesia, and then translated into English when needed by one of the authors. Further research to find socio-economic statistics was carried out at statistical offices in Lingga Island (regency), Bintan Island (provincial), and in Jakarta (national) to check official records of statistics. This combination is a form of triangulation that strengthens data collection and analysis and may help explain findings more fully and evaluate unexpected results that arise from using just one approach (Jick, 1979).

6. Research Findings and Discussion: Socio-Economic Impacts and the Sustainability of the Tin Mining on Singkep Island

The full survey results, in Bahasa Indonesia language, and interview transcripts, also in Bahasa Indonesia, are held at the University of Exeter, together with the original English versions of the survey, portions of the transcripts and the statistical information retrieved from official records in Indonesia translated into English. The answers to four main questions, together with the qualitative interviews and research on official statistics, are presented and discussed in more detail below.

6.1. Socio-economic benefits during active mining

Overall the survey respondents considered that tin mining has provided essential socio-economic benefits to support sustainable development on Singkep Island during

active mining. More than 50% cited improving ‘local employment’, ‘workplace health and safety’, ‘meeting public expectations’, ‘local community participation’ and ‘education and training opportunities’ while the mine was working (Figure 2).

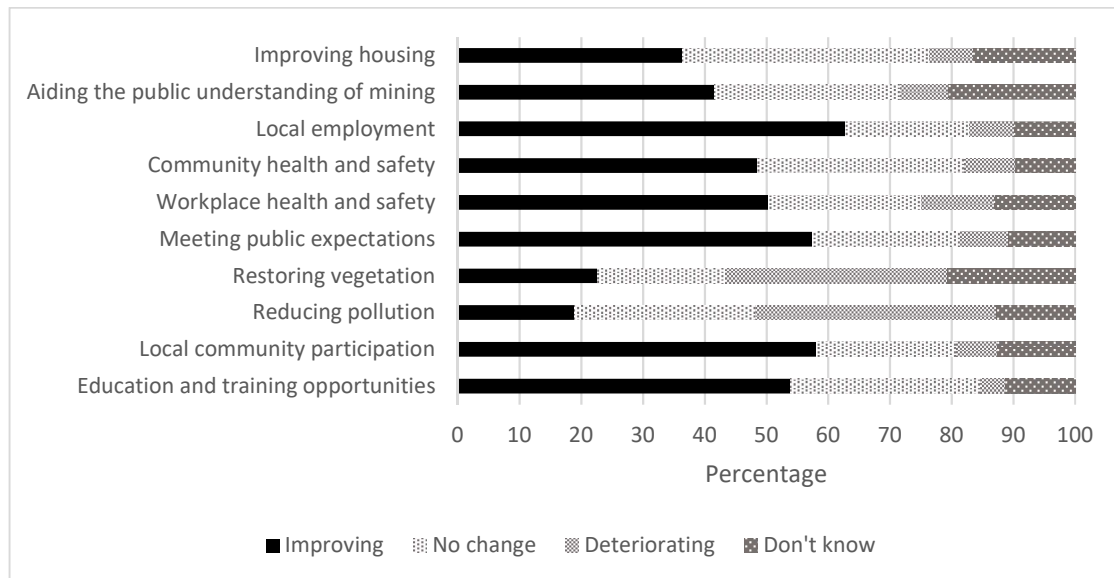


Figure 2. Performance of the former mining company in terms of essential socio-economic benefits to support sustainable development on Singkep Island
 Source: Survey 2018, Question 20, 'In your area, please indicate how the mining industry was performing in relation to the following factors'

Tin mining was the primary industry in Singkep and the only industry that could provide decent employment for the local community. It was the primary source of employment and became the main source of income for the majority of households. By the early 1990s, approximately one-third of the households depended directly on the single mining company. Indirect mining labour and mining services workers added to this number (Table 3).

Before mine closure in 1992, tin mining contributed around 65% -90% of the local economy (Ali, 2018, January 16; Mochtar, 2018, January 17; Riono, 2018, January

18), thus delivering a tremendous contribution to the island, despite it being relatively small in terms of national production.

Table 3. Population According to Livelihood, Singkep District in 1992

Occupation	Total	Percentage
Farmer	1 339	15.4
Fisherman	2 168	24.9
Animal Breeder	179	2.1
Medium / large entrepreneurs	9	0.1
Small Industry Craftsmen	23	0.3
Industrial Workers	641	7.4
Construction workers	762	8.7
Mine Workers	2 452	28.1
Trading sector	367	4.2
Transportation sector	47	0.5
Government employees	629	7.2
Military and Police	100	1.1
<i>Total</i>	8 716	100.0

Source: Singkep District in Figures 1991, 1993

The mining company also met the social and economic expectations of the population. Some examples of specific actions that helped this come from the ways in which the company provided housing equipped with electricity and mains drinking water, and subsidised their employees' households and thus helped to decrease poverty. The company allocated rice of 18kg per person for the employee, and 15kg for their spouse (Mukana, 1976). These numbers are above the average national consumption per capita per month, which is around 9 kg (Statistics Indonesia, 2019, July 8). The company also provided aeroplane transport and allocated vegetables, meat, and other provisions (butter, flour, clothes and shoes) to local government staff as well as company staff for most of the religious feasts.

The tin mining company also improved public participation in local decision making:

Public participation was generally intense when the tin mining company intended to develop new mining blocks or sites. The company usually negotiated with landowners regarding land compensation... Generally, the land acquisition negotiation was carried out in public meetings attended by the company representatives and the villagers... so that the whole community could agree together (Ali, 2018, January 16).

Although we could not find the official statistics for local economic growth despite searching local record offices, we can conclude that the community was generally far removed from the problems of famine or other threats such as the unavailability of energy and water. Singkep was a prosperous island with relatively wealthy communities, and mining was the main contributor to this.

6.2. Negative impacts of past mining

In addition to the environmental problems noted above (Figure 2), the adverse effects of mining that the local people were most concerned about were job dependency and the impacts on community health and safety and workforce health and safety (Figure 3). Nearly 70% of respondents considered that the presence of tin mining company has caused job dependency.

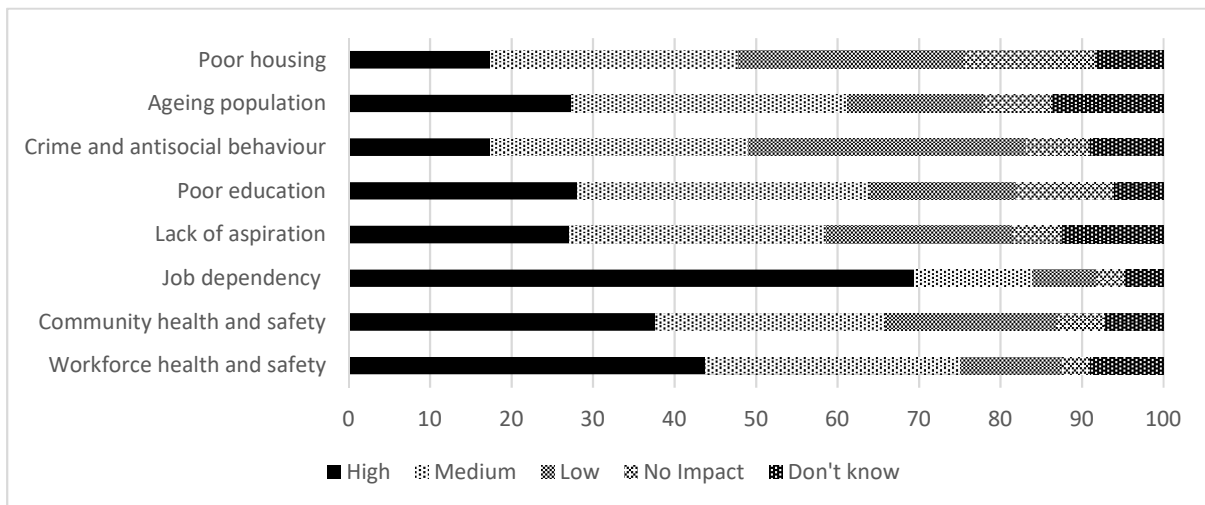


Figure 3. Negative impacts of past mining

Source: Survey 2018, Question 17, 'Please classify the following potential negative impacts of past mining in the Singkep island.'

We interpret that the geological, geographical and administration profile of Singkep Island led to the threat of economic dependence on mining. The island is geographically remote and separated from the mainland of Sumatera. It was located relatively far from the provincial and regency government centres as well as the regional economic development centres. Sea transport is the primary connection to the mainland, and as a result, the island is often temporarily isolated in windy weather conditions. To date, Singkep has benefited from limited government-supported economic development. Whilst it provided significant revenue for the local population and the government during tin mining activities, after mining the Island is facing a double tragedy. On one hand, it is neglected by the government, and on the other hand, it suffers from the ongoing negative tin mining legacies. As a result, despite the mineral wealth of the Island, domestic growth and infrastructure development have remained stagnant.

Around 44% and 38% of respondents stated that mining activities had a high negative impact on the health and safety of the workforce and the community, respectively. One of the most severe tin mining impacts on health was malaria because the abandoned pits (voids) became breeding areas for mosquitoes. One of the respondents suggests that:

...around 1983 there were about 120 abandoned voids identified. The former mines had become mosquito extraordinarily infested and the sources of malaria. That is the problem (Riono, 2018, January 18).

'Uncomplicated malaria' was the most widespread disease amongst residents in 1991 with 17 429 cases, about 37.5% of the total visits to the district community health centre (Statistics Officer of Singkep District, 1993). The malaria intensity in Singkep District was far higher than any other areas in the Riau Island Regency. The total number of malaria patient visits to all health facilities in the regency was around 25 000 in 1990 (Statistics of Riau Islands Regency, 1992). Assuming that the malaria cases in Singkep District in 1990 and 1991 were identical, the district had more than 70% of the total malaria cases in the regency, which is very significant considering the area had less than 10% of the population. The disease was one of the most severe health issues that the community had to deal with during and after mining cessation.

6.3. Long-term benefits from the presence of the mining

Nearly three decades after its cessation in 1992, tin mining had still left an impact on the local population.

Respondents noted that mining did not contribute to 'business opportunity related to mining' (66%), 'business opportunity unrelated to mining' (mining and non-

mining, 66%), 'school and training and educational facilities' (73%) not to 'hospitals and health facilities' (66%) (Figure 4). Therefore, the current inhabitants of Singkep claim that the presence of tin mining failed to generate substantial longer-term benefits, especially to the local people, although it was recognised as very important to the local economy (Ali, 2018, January 16; Riono, 2018, January 18).

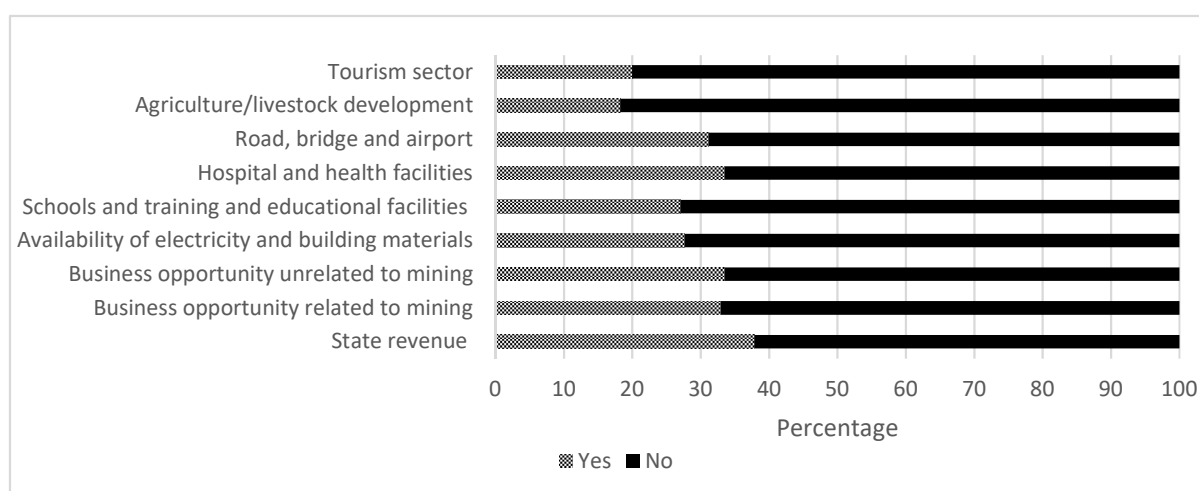


Figure 4. The majority of respondents noted no major long-term benefits from the presence of the mining
 Source: Survey 2018, Question 14, 'What have been the major benefits to the Singkep island from the presence of the mining industry?'

Our interpretation is that the local government did not have sufficient authority and capability to adequately govern the mineral wealth in a way that it would benefit the development of other sectors and sustain local socio-economic development. During the active mining period, the government and mining company rarely utilised the advantages of natural wealth to support other businesses, a diversification which is essential for local socio-economic development and was exacerbated by the luxury of working in tin mining.

From the perspective of local communities, mining certainly paid better than the alternative options. It, therefore, had led them to look for jobs in mining and stopped them seeking alternative activities. Because of the long history of tin mining in the region and high dependency on tin mining, the local people were unaware that tin mining would cease at some stage. Even the rapid decrease in tin price was not, at first, considered to be a threat to the mining operation. Rural communities do not always understand the financial implication of the mining sector, and the sudden closure meant that communities were poorly equipped in term of alternative skills. As a result, local people failed to create resilient and independent communities. They were always at risk of suffering socio-economic downfall in the long term after mine closure. The lesson from Singkep is that communities should diversify their revenue sources and not rely on the mining sector alone. This lesson is relevant today where many rural communities aspire to opportunities in the mining sector at the expense of sectors such as agriculture or fishing because mining has the potential to provide higher incomes to local communities (Diallo, 2017, 2019).

The mining company opened two popular primary schools and a student dormitory at a university in West Java so that students could travel there and continue into higher education (UPTS, 1983). However, these facilities targeted mainly the families of the mining employees and all of the facilities ceased when the mine closed in 1992 (Itam, 2018, January 18; Rahman, 2018, January 15).

...the luxurious education facilities were intended only for the children of the mining company's employees, not for outsiders. Some of the local people have also received scholarships, but again because they were the children of tin employees. I never heard (the education support) for outsiders (Ali, 2018, January 16).

Meanwhile, the government did not promote finite natural resources transformation into a more sustainable human capital to compensate for the foreign exchange generated by the intensive mineral exploitation. The government primary schools, for instance, were less competitive compared to those managed by the mining company (Itam, 2018, January 18). The education beneficiaries promoted by the mining company, in contrary, left the Island when mining ended, or earlier. As a result, when mining ended, those who decided to stay on the island were local community members who were relatively unskilled, and less educated (Ali, 2018, January 16).

The healthcare sector was similar. The mining company controlled the only hospital on the island, but the standard and quality of services drastically dropped after the mine closed. The local government, which took charge of the management of the infrastructure was powerless and lacked resources and budget allocation to manage the assets suddenly transferred to the government (Mochtar, 2018, January 17; Riono, 2018, January 18). The findings from this research illustrate that tin exploitation did not contribute to the sustainable socio-economic growth of the local population through good quality education nor healthcare. This type of situation had caused the collapse of the spheres of sustainability and society (Magis & Shinn, 2008).

During the time that the tin mining operations were active, all the major equipment such as dredgers and spray/hydraulic machines, transportation equipment, and other supporting tools was imported (Mukana, 1976). Singkep Island did not have the resources necessary to support the production of sophisticated machinery for mining. The local economy lacked financial support, infrastructure, supply chain, and technological capacity. Most of the maintenance facilities belonged to the mining

company, including diesel engine workshops and welding/plate workshops (UPTS, 1983). As a result, the role of local suppliers was minimal and usually limited to simple materials such as nuts and bolts (Riono, 2018, January 18). Overall the range of linkages between the tin mining operations to the domestic economy was low.

The tin ores obtained from hydraulic mining or dredgers were washed to produce concentrates and then transported to the smelter in Mentok, Bangka Island (UPTS, 1983). With no smelting (i.e. refining) on the island, the value chain effects for Singkep Island itself were limited. The relatively short-chain did not generate significant benefits in increasing value or in economic opportunities for local people to diversify jobs.

The mining company subsidised their employees' basic household needs, but instead of giving cash to trigger domestic purchasing, they provided the benefits described above in the form of imported goods. This policy substantially cut-off the potential local expenditure of the mining workers' households. The impacts were particularly significant because mining families were the largest community in Dabo as well as the group with the highest purchasing power on the island (Ali, 2018, January 16; Riono, 2018, January 18). Therefore, the advantages of tin mining in the form of final-demand linkages to promote local growth were much lower than they should have been.

The local government lacked the authority, access and technical capacity to deal with a state company which had the full support of the central government and thus the legitimacy of the local government representatives was weakened. The company needed only to consult with the central government if it (the company) wanted to

carry out actions which would have impacts on the local people (Mochtar, 2018, January 17) such as the mine closure (Mangkusubroto, 2018). In this case, the established system made the company almost the single-player in the governance of mining on Singkep Island, as a member of the Board the Lingga Regency

Representative from Singkep District explained:

When the tin mining was active, mining permits and supervision were under the full authority of the central government who made most of the land on Singkep Island as tin mining concessions. In the meantime, the mining company was the institution that built and provided almost all public facilities and services on Singkep Island. Consequently, the district level government did not have comparable bargaining position both administratively and authority over the company (Riono, 2018, January 18).

As a result, the mining company lead was allowed to lead the regional socio-economic development strategy on Singkep Island. The infrastructure developments on the island were also due to the company's investment, and the government did not invest in public services. The island's infrastructure was too concentrated on supporting mining industry operations. Neither the socio-economic nor the infrastructure investments helped to encourage other economic sectors ready for a post-mining environment, even though Singkep was important in earning foreign revenue for Indonesia. The established ecosystem during the active mining resulted in negative regional growth (Fleming & Measham, 2013). This imbalanced development meant that post-closure, the local population could not maintain the civil infrastructure built during mining. When mining stopped, the infrastructure was abandoned.

The circumstances in Singkep Island before mine closure failed to create a favourable environment for business growth to support economic diversification. The number of large, medium and small business actors were only 0.4% of the total workforce in 1992 (Statistics Officer of Singkep District, 1993). Thus, our research reveals that poor governance coupled with weak linkage across different sectors hampered local socio-economic development and sustainability. Consequently, the economic benefits of the mining operation could not be sustained once the mine was closed.

6.4. Main socio and economic changes since mine closure

Questions were asked to capture the main socio-economic changes on Singkep Island since the cessation of tin mining. Sixty-nine per cent of respondents considered that there has been a decline in community income since mine closure in 1992 (Figure 5), and 56% said that job variety has declined. This indicates that the economic contribution from mining disappeared soon after mine closure. Land quality continues to deteriorate due to abandoned mines and voids, triggering other socio-economic problems such as malaria as explained in section 6.2, and loss of farming opportunities owing to degraded land. Education was relatively unaffected because most children attended state schools. The mine cessation meant that exclusivity in education was eliminated and the public has equal access to primary schools. The local government also began to significantly improve affordable education facilities since 2004, more than ten years after the mine closure (Wello, 2017, December 10).

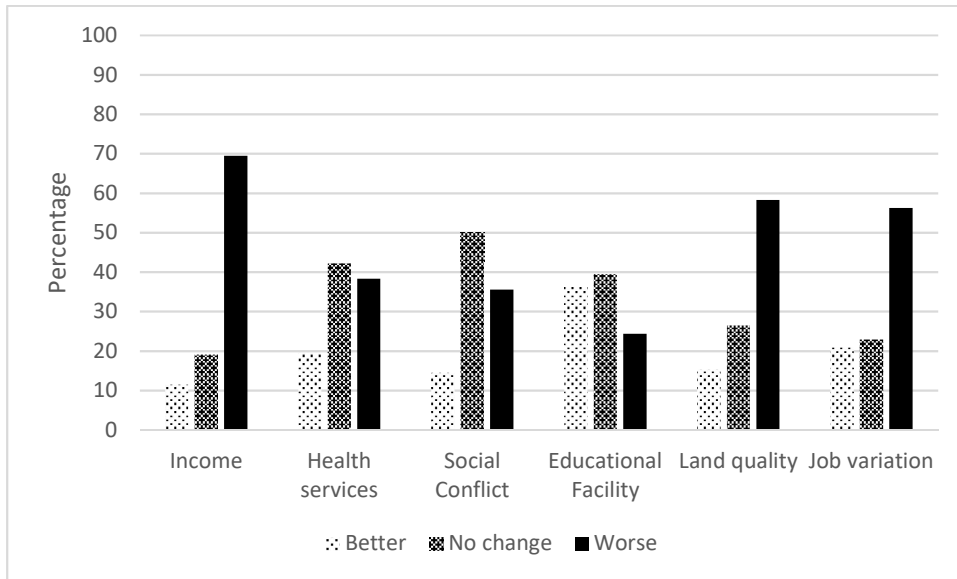


Figure 5. Main socio and economic changes

Source: Survey 2018 Question 15 'What are the main socio and economic changes (both positive and negative) before and after the mine closed?'

Severance pay to mine employees maintained short-term local economic performance. Six months after the mining company left, unrest began to emerge as wealth ran out, and the need for work became obvious. Employment was at the lowest point with very few jobs available. The community then realised there would soon be an economic recession, and they needed to find a way to survive.

Many of the workforce migrated away from the island (Ali, 2018, January 16; Mochtar, 2018, January 17; Riono, 2018, January 18). The Singkep district population declined from 39 000 in 1990 to around 35 000 in 1994, approximately 8% lower (Statistics of Riau Islands Regency, 1992, 1996). The population in 2000 was around 36 000 (Statistics of Riau Islands Regency, 2001), which is still below the number in 1990. Besides causing a significant decline in the productive age population, the migration also led to family separation for a relatively long period of time, and this is suspected

to be a trigger of domestic and social pressures and depression, although there are no official data (Ali, 2018, January 16; Mochtar, 2018, January 17; Rahman, 2018, January 15).

The total migration after the mine closure was not precisely recorded because people moved without reporting to the civil registration office. For instance, the population of Kuala Raya, one of the villages on the island, decreased from 4000 in 1992 to about 3000 in 1994, about 25% shrinkage (Ali, 2018, January 16). This reference suggests that the population decline was higher than the official records, and therefore, the official numbers need to be taken with caution. The district's low population growth could be a proxy for the weak local socio-economic development in the early years after closure and has continued for many years afterwards.

These profiles indicate that most of the benefits disappeared when mining ended, but the negative impacts continued. Our longer time-frame approach that includes an analysis of the socio-economic profile years after the mine closure shows that Singkep Island is suffering from a resource curse phenomenon and that the development of the mineral-rich region was unsustainable.

The research findings reveal that to contribute to sustainable mining and ensure that mining contributes to sustainable development, it is essential to plan for closure at the start of mining. Planning for closure early in the mining life cycle, as well as promoting economic diversification using repartition of revenues to generate resilient and independent societies, will prevent local communities having to suffer from some of the challenges illustrated in this case study. While mining can provide

jobs, it is important to diversify the economy to ensure that communities become less dependent on mining and can have ongoing activities after closure.

The accumulation of geographical barriers, imbalance of scale and power, and the lack of realistic options to diversify the local economy during the historical tin mining period created communities that are trapped in a condition which Freudenburg (1992) calls an economic dependent and vulnerable society. After the closure in 1992, the tin island immediately fell into the worst economic recession in its history, triggering slower socio-economic development because the population were unable to benefit from their local resource. This experience is consistent with Eggert (2001) that mineral resource wealth does not always positively correlate with sustainable development.

Besides the poor mining governance, the negative development of Singkep Island happened because its stakeholders lacked knowledge of best practices in sustainable mining. This topic emerged throughout the 1990s and following decade (ICMM, 2020). Unfortunately sustainable mining best practices were not applied during the active tin mining on Singkep Island.

We further argue that there is an important opportunity to improve mining performance following the recent global initiatives to maximise the contribution of mining to sustainable development. Mamonto et al. (2012) analysed PT Newmont Minahasa Raya's post-mining programs in North Sulawesi, Indonesia by comparing the three pillars economic, social and environmental aspects in the villages around the company's operational area before, during and after mining. Following the company's commitment to best practice, government support and the acceptance and

cooperation from the community, the researchers found essential changes in community socio-economic profiles based on the surveys conducted in 1994, 2004 and 2011. The post-closure survey in 2011 reported that average expenditure and house ownership, health facilities, community education level, as well as sanitation and water supply, were all better after closure. These findings show that mines that comply with the proper guidelines on corporate social responsibility, best mining practices and social-economic impacts can contribute to sustainable development. We should note that the case of PT Newmont Minahasa Raya was not a sudden and unplanned closure.

Singkep Island is a lesson for Bangka and Belitung islands and other mining regions in Indonesia and globally. Mining regions should maximise the positive impact of mining projects on local communities through:

- Improvement of the resources necessary to support mining operations, such as financial support, infrastructure, supply chain, and technological capacity.
- Appropriate management of mineral royalties, mining taxes and guarantees to support local communities in transition after the mine has been closed, including environmental remediation and social impacts mitigation.
- Promotion of local content policy and encouragement of livelihood diversification through CSR programmes during the active mining.
- Enforcement of Environmental and Social Impact Assessment which include the options for sudden closure, and establish ongoing

stakeholder engagement to build mutual awareness of mine closure and prepare to cope with it.

- Intensively promote capacity building to make communities resilient and equipped to explore a range of opportunities for economic diversification. Measures such as local vocational training and local non-mining project development will all help to decrease the regional fiscal dependency on resource wealth and to anticipate misused and mismanaged of mineral revenues.

We further suggest that governments should improve related legislations and policies to support the implementation of these measures. Most importantly, the above suggested mitigation measures should be carried out as early as possible to anticipate that sudden closure, such as happened at Singkep, may occur at any time. The findings from this paper show that the regional level governance is crucial in mining – as recognised by the OECD mining regions projects (OECD, 2019) and the MIREU mining and metallurgy regions of Europe horizons 2020 coordinating and support action (CORDIS, 2020).

7. Conclusions

The socio-economic history of the population on Singkep Island confirms that the benefits of mining are not always sustainable in the long term, particularly where unplanned and sudden mine closure occurs. While the historical tin exploitation provided benefits such as jobs and economic growth, educational and health facilities and infrastructure, many of these benefits ended with the mine closure, which also

triggered the emergence of different problems alongside the ongoing negative environmental impacts. Thus the local communities have had a long term double burden.

This research emphasises that short-term mineral benefits may turn into losses at the end of mining if mine closure has not been effectively planned and little attempt has been made at economic diversification. The case study of tin mining on Singkep Island is a good example of unsustainable development in mineral-rich regions, at regional levels or on remote islands. While many researchers claim that, the Indonesian economy has successfully released itself from the resource curse trap (Auty, 2006; Birdsall et al., 2001; Mikesell, 1997; Rosser, 2007), the research findings here show the opposite. The source of this contradiction is in the different context, in which the former researchers have analysed information at the national scale, while the resource curse phenomenon in Singkep Island existed at the regional level. This national versus regional effect emphasises that attention to regional as well as national development is important and mitigation strategies targeted at regional level are needed to prevent such mistakes in the future.

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