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Research Article

Integrating Biodiversity and Livelihood Protection in Mining Operations in Garcia-Hernandez, Bohol

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ABSTRACT

Mining operations pose a significant threat to biodiversity and the livelihood of community people. Residents living near the mining sites must adjust to the changes brought about by the onset of mining activity, especially with their lost livelihood. Mining companies must provide alternative livelihood for residents to ensure sustainability. However, some livelihoods are not aligned with the Department of Environment and Natural Resources Administrative Order 2022-004. This study assessed the alignment of livelihood projects, reasons for not passing the Biodiversity Friendly Enterprise (BDFE) index, and suggested livelihood projects. The questionnaire gathered items indicated from the administrative order as a standard for passing the said index. The result revealed that most livelihood projects do not conform to the administrative order. The most glaring issues are the financial constraints and insufficient information about the BDFE index. Proposed livelihood projects on Traditional Hilot and Cacao Production proved to be highly supported in preserving traditional practices and furthering agricultural industries. Enhancing our capacity, improving project planning processes, and incorporating community feedback into livelihood projects to achieve better outcomes is essential. This will increase compliance with the DAO guidelines and promote sustainable community development. Additionally, these findings have implications for better adoption of the BDFE Index, as it is crucial to provide enhanced information and address financial constraints.

Keywords: *Mining, BDFE index, Livelihood, Biodiversity, DAO 2022, Bohol, Philippines*

Introduction

The proliferation of the mining industry has been a usual trend. While mining operations positively affect the economy, it cannot be denied that the result of mining activities can be risky. This significantly impacted biodiversity and the people living in the area. On top of these, mining activities can hamper people's

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livelihood, primarily if the area to be mined is agricultural. Since the place they are living is their source of income, starting mining operations can affect their lives by taking away the means of livelihood that they have.

Mining companies, among others, have the most significant impact on biodiversity and people's livelihoods. In Chile, this has been a concern of the people since organisms and people living in the area are deeply affected (Carranza et al., 2020). When this happens, the good benefits of mining to the community will be defeated by its negative impacts. People living in the area are the first and foremost concern, and their means of survival, which is their livelihood, needs to be considered.

According to a study in Kenya, mining did not help some households acquire assets. Several issues arise when large-scale mining causes loss of agricultural land due to mining pits and poor rehabilitation, reducing crop yields and poor living standards. Some established mining companies in the area did not compensate or share their accrued revenues or support development projects, as was expected. As such, the improvement brought about by mining was not sustainable for communities' livelihoods (Mwakesi et al., 2020).

In some Asian countries, large-scale and artisanal small-scale mining has significantly degraded natural resources and altered local livelihood strategies. This affects people experiencing poverty, who may perceive ASM as a vital means to enhance income and underpin the survival of precarious livelihoods—often at significant cost to environmental health and personal well-being. Providing alternative livelihoods is necessary so people can adapt to change while living a sustainable life (Keoyilignayong, 2019).

The mining companies must provide a sustainable alternative to the lost livelihood of the community. They may conduct rural programs to help resettled community people adapt to the situation (Osumano, 2020). The Philippine government has institutionalized the Social Development and Management Program as the framework to ensure that mining operations would genuinely benefit the local community. The SDMP addresses health, education, infrastructure, and livelihood development—socio-economic impacts of mining. Integrating biodiversity protection into SDMP will ensure mining is conducted to advance community development and preserve ecological integrity.

This aligns with the 2030 Agenda adopted by all the member nations of the United Nations, which is termed Sustainable Development Goals (SDGs). SDG 8 – Decent Work and Economic Growth, as well as SDG 11 Sustainable Cities and Communities, reflect the need to promote sustainability in communities so that they will have a source of livelihood amidst changes. SDG 8 – Decent Work and Economic Growth, as well as SDG 11 Sustainable Cities and Communities, reflect the need to promote sustainability in communities so that they will have a source of livelihood amidst societal changes. In this way, they will be empowered communities that can survive given the resources and opportunities (United Nations, 2023).

Under DENR Administrative Order No. 4 series of 2022, Section 8, mining companies are committed to integrating biodiversity conservation and protection into their Social Development and Management Program. This shall include activities on biodiversity-friendly enterprises, propagation of indigenous plant species, establishment of green parks, and agroforestry, which will generate green work and provide better livelihoods during and after mining operations.

Areas in the Philippines have been subjected to mining operations. To do such, there are a series of processes, including communication, implementation, monitoring, and evaluation. Aside from the mining itself, it is one of the responsibilities of mining companies to take charge of livelihood projects that can serve as an alternative for people living in the area. Doing so will enable both parties to go on with life as usual and avail themselves of resources.

Garcia-Hernandez is a municipality in Bohol, Philippines, that is well known for its abundant natural resources and high biodiversity. The area's ecology is significant because it contains various flora and fauna, major contributors to the local and regional ecosystem services. Increased interest in mining operations within the region has threatened these natural resources considerably. The challenge,

therefore, becomes one of balancing economic development with environmental sustainability and community welfare.

These resources are critical to the livelihood of community people. When these resources are affected, their livelihood is affected as well. In some instances, the mining itself is the location of their work. Integrating biodiversity and environmental protection into the SDMP is one of the critical factors for Garcia-Hernandez's sustainable mining practices.

Given this, the objective of this study will be to investigate the existing practices of mining companies that deal with the conservation of biodiversity and livelihood projects. It also aims to identify why these livelihood projects failed the BDFE index. More so, the suggested livelihoods are also explored. This study focuses on the Calma United Farmers Association (CUFA) and the Libertad Parents & Youth Association (LIPAYA).

Specifically, this study seeks to answer the following questions:

1. Is the existing livelihood implemented by the mining in line with the Guidelines under DAO 2022-004? (Specific to Section 8)
2. What are the reasons why the said existing livelihood did not pass the BDFE index
3. What are your suggested livelihoods for DAO 2022-004?

Methods

Research Design

This study utilized a descriptive research design. This type of research design explores variables as they are (McCombes, 2023). It mainly describes variables; no variable is controlled or assessed for effectiveness. This design is appropriate for assessing the compliance of livelihood projects and gathering the reasons for failure behind the BDFE index.

Research Environment

This research is conducted at Garcia-Hernandez, Bohol, Philippines. It is called the Limestone Capital, and it is the main product of the area. The municipality's general topography is characterized by broken hills that push toward the sea, leaving small valleys between them that permit little patches of level land to nestle close to the shoreline. A narrow, fertile valley meanders along the course of the Manaba River, which originates from the highlands of Barangay Cambuyo.

Research Respondents

The profile of the respondents is presented in Table 1.

Table 1. Profile of the Respondents

Profile	CUFA	LIPAYA
Sex		
Male	4	0
Female	31	20
Age		
18-24	0	3
25-34	0	2
35-44	3	4
45-55	9	5
>55	23	6
Length of Residence		
1-3 years	0	1
> 3 years	35	19
Educational Attainment		
Elementary	17	7
High School	14	10
College Graduate	2	2
Graduate School	0	0

Profile	CUFA	LIPAYA
Vocational	2	1
Civil Status		
Single	0	1
Married	23	18
Separated	1	0
Widowed	11	1
Occupation		
Unemployed	32	13
Government	3	6
Private	0	1
Monthly Income		
Less than 1000	26	10
1001-5000	7	6
5001-10000	2	4

Table 1 shows the profile of the two groups: CUFA and LIPAYA. Sex breaks down into four male and 31 female respondents for the former, while the latter had only 20 female respondents. It, therefore, implies that the former has a bad imbalance in the sex category, with a fair male presence, while the latter is composed only of female participants. From the point of view of age, most respondents in the case of CUFA were older, with a hefty majority of 70% aged over 55 years. In contrast, LIPAYA has an almost equal share of age groups: the 18-24 and 25-34-year-olds contrast sharply with the older demographic of CUFA.

Regarding the length of residence, CUFA had 35 respondents living in the area for over three years, while LIPAYA had 19 with a residence of over three years. In addition, LIPAYA has one respondent with a residence duration of 1-3 years. The case of 1-3 years at CUFA remains unspecified, making it challenging to compare thoroughly. In terms of educational attainment, as shown in Table 4, there are more respondents with only elementary education in CUFA with 17 as opposed to LIPAYA. At the same time, LIPAYA had fewer respondents with elementary education but showed a more balanced distribution among those who finished high school and those with vocational qualifications.

Descriptive data on civil status indicate that the CUFA respondents are married mainly—77% with no single respondents—against 23% being widowed. In contrast, LIPAYA is essentially married, 90% with a sprinkling of single and widowed. Thus, marital status varies more in LIPAYA than in CUFA.

While on occupation, CUFA has a far higher number of its respondents unemployed, 32, compared to LIPAYA, which has a more even distribution, with some of its respondents employed by the government or private sectors. Lastly, on monthly income, generally, the CUFA respondents have lower incomes, with a high proportion earning less than 1000 per month. LIPAYA indicates a higher distribution in the 5001-10000 income bracket, showing a relatively higher income level among the respondents.

This means that LIPAYA is in contrast with CUFA regarding demographic characteristics. CUFA is the older, less educated, and lower-income group compared with the more diversified and slightly better-off group that LIPAYA is.

Research Instrument

This study utilized the Rapid Assessment for BDFE Enhancement Eligibility stipulated in the DENR Administrative Order No. 13 series of 2021 to determine whether the livelihood projects passed the BDFE index. A self-made questionnaire determined the reasons that hindered the projects' passing and suggested projects.

Data Gathering Procedure

A questionnaire was distributed among the respondents to gather the data. There were two groups of respondents: CUFA and LIPAYA. There were 35 respondents for CUFA and 20 respondents for LIPAYA. The consent of the respondents was asked before distributing the questionnaire.

Data Analysis

Statistical tools were used to analyze the data. For the profile, frequency and percentage were used. A percentage was used to determine the alignment of livelihood projects to DAO 2022-004. The same tools were used to determine the reasons and suggestions for livelihood projects.

Result and Discussion

The research methodology met the objectives of this study. The results are presented and discussed in this section.

Existing Livelihood Implementation Alignment with the DAO 2022-004 Section 8 Guidelines

This study assessed the existing livelihood projects and their alignment with DAO 2022-004. The BDFE index was used to determine whether a project passed or not. Table 2 shows the result.

The table shows the alignment of livelihood projects concerning the DAO 2022-004 Section 8 guidelines. Generally, the result reveals that most of the livelihood projects failed. Out of 55 livelihood projects, only ten failed, with a passing rate of 18.2% and a failing rate of 81.8%. For the CUFA, 26 livelihood projects failed, while nine passed. This yields a 74.3% failing rate and a 25.7% passing rate. LIPAYA exhibited a much lower passing rate of 5%, wherein only 1 out of 20 livelihood projects passed. The failing rate is 95%.

Table 2. Existing Livelihood Implementation Alignment with the DAO 2022-004 Section 8 Guidelines

ORG	BDFE INDEX (%)	REMARKS
CUFA	93.8	**PASSED**
CUFA	93.8	**PASSED**
CUFA	56.3	FAILED
CUFA	56.3	FAILED
CUFA	62.5	FAILED
CUFA	62.5	FAILED
CUFA	75.0	FAILED
CUFA	81.3	**PASSED**
CUFA	93.8	**PASSED**
CUFA	100.0	**PASSED**
CUFA	93.8	**PASSED**
CUFA	50.0	FAILED
CUFA	56.3	FAILED
CUFA	56.3	FAILED
CUFA	43.8	FAILED
CUFA	62.5	FAILED
CUFA	62.5	FAILED
CUFA	62.5	FAILED
CUFA	62.5	FAILED
CUFA	56.3	FAILED
CUFA	50.0	FAILED
CUFA	56.3	FAILED
CUFA	81.3	**PASSED**
CUFA	56.3	FAILED
CUFA	56.3	FAILED

ORG	BDFE INDEX (%)	REMARKS
CUFA	68.8	FAILED
CUFA	68.8	FAILED
CUFA	56.3	FAILED
CUFA	56.3	FAILED
CUFA	68.8	FAILED
CUFA	62.5	FAILED
CUFA	87.5	**PASSED**
CUFA	62.5	FAILED
CUFA	100.0	**PASSED**
CUFA	62.5	FAILED
LIPAYA	56.3	FAILED
LIPAYA	68.8	FAILED
LIPAYA	43.8	FAILED
LIPAYA	68.8	FAILED
LIPAYA	56.3	FAILED
LIPAYA	56.3	FAILED
LIPAYA	50.0	FAILED
LIPAYA	56.3	FAILED
LIPAYA	68.8	FAILED
LIPAYA	56.3	FAILED
LIPAYA	56.3	FAILED
LIPAYA	62.5	FAILED
LIPAYA	62.5	FAILED
LIPAYA	68.8	FAILED
LIPAYA	68.8	FAILED
LIPAYA	56.3	FAILED
LIPAYA	43.8	FAILED
LIPAYA	62.5	FAILED
LIPAYA	56.3	FAILED
LIPAYA	100.0	**PASSED**

ORG – Organization

Table 3. Summary of the Existing Livelihood Implementation Alignment with the DAO 2022-004 Section 8 Guidelines

ORG	NEL	NOF	NOP	POF	POP
CUFA	35	26	9	74.3	25.7
LIPAYA	20	19	1	95	5
TOTAL	**55**	**45**	**10**	**81.8**	**18.2**

ORG – Organization; NEL – Number of Existing Livelihood; NOF - Number of Failed; NOP - Number of Passed; POF – Percentage of Failed; POP – Percentage of Passed

The result indicates that the livelihood projects are not compliant with the guidelines. The implications of these findings are enormous. High failure rates suggest comprehensive reviews of the existing livelihood programs must be done to determine gaps in compliance with DAO guidelines. In the case of CUFA, the exceptionally high failure rate may indicate more deep-seated problems with how projects are being executed or managed and should thus be dealt with urgently. The close-to-universal failure rate of LIPAYA signals that even fewer of their projects are meeting the required standards, hence a critical need for focused improvement.

There are problems with implementing livelihood projects. The characteristics of the beneficiaries must be assessed to implement a better livelihood project for them. This will help them achieve sustainable communities that can focus on generating resources through the alternative income sources provided for them (Cobbinah et al., 2015).

Both organizations may have further investments in training, capacity building, and support needed to build their capabilities and adhere to DAO guidelines. This could be in terms of updating procedures for planning projects, strengthening compliance with regulatory requirements, or setting up more robust systems of support for the implementation of projects. These challenges need to be addressed if there must be an increase in the success rate of livelihood initiatives and better conformance to the set guidelines.

Livelihood projects need to revisit the BDFE index for sustainability (Amatorio et al., 2020). Projects initiated for the benefit of the community must always consider their impact on the environment. In this way, they can be continued and have a limited impact on the environment so that future generations will also benefit.

Reasons that Hinder to Pass the BDFE Index

Since the result indicates that the livelihood projects do not pass the BDFE index, it is imperative to determine the reasons that hinder its passing. The result is shown in Table 4.

The table shows several reasons that the most significant barriers to the passing of the livelihood project are related to information and financial issues. Financial support is lacking, which constitutes 20% of the respondents. CUFA members have reported more significant financial problems, 25.8%, than LIPAYA members, 10.5%. This proves that financial constraints are a significant hindrance, which could be ascribed to meager funding or the appropriation of existing resources.

Table 4. Reasons that Hinder to Pass the BDFE Index

REASONS	FREQUENCY & PERCENTAGE (%)					
	C	%	L	%	T	%
Financial assistance	8	25.8	2	10.5	10	20.0
Lack of information about BDFE	6	19.4	7	36.8	13	26.0
Lack of interest	6	19.4	0	0.0	6	12.0
Lack of support	1	3.2	0	0.0	1	2.0
Lack of unity in the local community	1	3.2	0	0.0	1	2.0
Misaligned livelihood implementation	2	6.5	0	0.0	2	4.0
No knowledge about the new policy	3	9.7	4	21.1	7	14.0
Unavailable raw materials	4	12.9	6	31.6	10	20.0
TOTAL	**31**	**100**	**19**	**100**	**50**	**100**

C – CUFA; L – LIPAYA; T - Total

Another critical issue is the lack of information regarding the BDFE Index, which reportedly has been a major problem for 26% of the respondents, more so with LIPAYA members at 36.8% compared to 19.4% with CUFA. This reflects the potential necessity for more communication and outreach on the BDFE Index.

Lack of interest is another significant barrier affecting 12% of the respondents and unique to CUFA. This could suggest that this is not interesting or relevant to this group. The low total percentage for lack of local community support and lack of local unity, both 2%, would indicate that although these are concerns, they are much less important than the financial and informational barriers. Next are smaller proportions, misaligned livelihood implementation, and lack of knowledge about the new policy, which weigh in at 4% and 14%, respectively, pointing to more specific, targeted concerns. Lack of livelihood diversification poses a threat to the way community people

view such alternative livelihoods. While benefits are achieved through mining, the number of livelihood projects must be considered (Shoko & Mwitwa, 2015).

Low participation, extra-local alliances, and distrust of the government and extractive industries usually raise resistance from affected communities by mining. Significant environmental damage might provoke a sense of intensity amongst people to fight back against the projects causing the damage. Policies will likely be opposed when the stakeholders feel ignored or excluded from decision-making, placing such communities in frustration and anger. The local movements can be strengthened by extra-local coalitions that provide outside resources and support for increasing opposition. Moreover, all this is aggravated by a general distrust of extractive industries and government officials at all levels, which further reinforces the opposition movement, making it more organized (Conde et al., 2017).

These findings further have implications for better adoption of the BDFE Index in that enhanced information provision and alleviation of financial constraints are essential. Mechanisms for increasing the quantum of financial support and comprehensive informational campaigns could help tremendously in bridging the knowledge gap. Involving members in matters of interest and relevance should be able to take it forward toward broader acceptance and implementation.

Suggested Livelihoods that are Applicable to DAO 2022-004

In addition, the respondents suggested several livelihood projects that apply to the guidelines and their preferences. Table 5 shows the result.

Table 5. Suggested Livelihoods that are Applicable to DAO 2022-004

SLP	FREQUENCY & PERCENTAGE					
	C	%	L	%	T	%
Banana Production and Dried Fish	1	2.9	4	20.0	5	9.1
Cacao Production and Dried Fish	10	28.6	5	25.0	15	27.3
Fishing	2	5.7	0	0.0	2	3.6
Local Delicacy	4	11.4	0	0.0	4	7.3
Traditional Hilot	16	45.7	9	45.0	25	45.5
Ube Jam	2	5.7	2	10.0	4	7.3
TOTAL	**35**	**100**	**20**	**100**	**55**	**100**

SLP – Suggested Livelihood Projects; C – CUFA; L- LIPAYA; T - Total

The data gathered on the suggested livelihood projects reflect the community's preferences. Almost half of the respondents suggested Traditional Hilot as a livelihood project, 45.7% for CUFA and 45% for LIPAYA. This high proportion indicates powerful community sentiments toward preserving and promoting traditional health and wellness practices.

Another primary preference is Cacao Production with Dried Fish, especially among the members of CUFA and LIPAYA, with 28.6 percent and 25.0 percent, respectively, totaling 27.3 percent of the suggestions. This explains a significant interest in agricultural ventures associated with food products that are considered traditional but can nevertheless yield economic benefits through agribusiness and value-added food products. Because of this, agricultural livelihood is declining in areas with mining activities. This can be pointed out using agricultural lands (Antwi et al., 2017)

The fishing subsector holds the lowest interest, accounting for only 3.6 percent of the total suggestions, with none from LIPAYA. This may connote an oversaturation of fishing activities or limited perceived opportunity in this sector. Third is Local Delicacy, which was uniquely suggested by CUFA members at 11.4 percent, reflecting a particular interest in local culinary products that might cater only to niche markets but do not have any broad appeal across the board.

The relatively modest interest in Ube Jam, at 5.7% from CUFA and 10.0% from LIPAYA,

suggests that the potential for developing local products does exist, but at moderate levels. Again, this may not be a priority, but it can be a niche to pursue. Based on the data, the community has a strong penchant for traditional and culturally rooted livelihoods in health practices and agricultural ventures that could guide further economic development and support programs within the community.

Community people living in areas affected by mining prefer diverse livelihood projects to make sustainable development possible. While providing livelihood projects is a good move, catering to the diverse preferences of the community's community will make this even more effective (Segerstedt & Abrahamsson, 2019).

Conclusion

Existing livelihood projects present a wide mismatch regarding the DAO 2022-004 Section 8 guide. Most projects did not meet the required standards. Specifically, CUFA projects show a high failure rate, indicating systemic flaws in project implementation and management. On the contrary, LIPAYA projects indicate a very high failure rate, a clear indication of critical gaps in compliance and implementation. Across the board, financial constraints and insufficient information about the BDFE index were identified as the primary reasons for failure. Barriers to better compliance and more significant project success need to be addressed with increased financial support and informational outreach. Moreover, it brought out the need to realize livelihood projects that respond to community preferences and environmental sustainability further. Proposed livelihood projects on Traditional Hilot and Cacao Production proved to be highly supported in preserving traditional practices and furthering agricultural industries. In the future, CUFA and LIPAYA must build capacity, sharpen processes for planning projects, and integrate community feedback into livelihood projects for better results. In this way, greater harmony with the DAO guidelines will be achieved, and sustainable development will be promoted within the affected communities.

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References

Amatorio, R., Torre, M. D., Pajaro, M., Raquino, M., Watts, P., & Zafra, E. (2020). Egongot tribal development and an NGO as a catalyst for sustainability. *Fourth World Journal*, *19*(2), 25-42.

Antwi, E. K., Owusu-Banahene, W., Boakye-Danquah, J., Mensah, R., Tetteh, J. D., Nagao, M., & Takeuchi, K. (2017). Sustainability assessment of mine-affected communities in Ghana: Towards ecosystems and livelihood restoration. *Sustainability Science*, *12*, 747-76

Carranza, D. M., Varas-Belemmi, K., De Veer, D., Iglesias-Müller, C., Coral-Santacruz, D., Méndez, F. A., ... & Gaymer, C. F. (2020). Socio-environmental conflicts: An underestimated threat to biodiversity conservation in Chile. *Environmental Science & Policy*, *110*, 46-59.

Cobbinah, P. B., Black, R., & Thwaites, R. (2015). Biodiversity conservation and livelihoods in rural Ghana: Impacts and coping strategies. *Environmental Development*, *15*, 79–93.

Conde, M., & Le Billon, P. (2017). Why do some communities resist mining projects while others do not? *The Extractive Industries and Society*, *4*(3), 681-697.

Keovilignavong, O. (2019). Mining governance dilemma and impacts: a case of gold mining in Phu-Hae, Lao PDR. *Resources Policy*, *61*, 141-150.

McCombes, S. (2023, June 22). *Descriptive research: Definition, types, methods, examples*. Scribbr.

Mwakesi, I., Wahome, R., & Ichang'i, D. (2020). Mining impact on communities' livelihoods: A case study of Taita Taveta County, Kenya. *AIMS Environmental Science*, *7*(3), 286–302.

Osumanu, I. K. (2020). Small-scale mining and livelihood dynamics in North-Eastern Ghana: Sustaining rural livelihoods in a changing environment. *Progress in Development Studies*, *20*(3), 208-222. https://www.scribbr.com/methodology/descriptive-research/

Segerstedt, E., & Abrahamsson, L. (2019). Diversity of livelihoods and social sustainability in established mining communities. *The Extractive Industries and Society*, *6*(2), 610-619.

Shoko, P. M., & Mwitwa, J. (2015). Socio-economic impact of small-scale emerald mining on local community livelihoods: the case of Lufwanyama district. *Int J Educ Res*, *3*, 14.

United Nations. (2023). *The 17 goals | sustainable development*. https://sdgs.un.org/goals