The Impacts of Mining on Livelihood and Development in Nyoenpaling Chiwog under Phuntshopelri Gewog, Samtse

Chheku Wangchuk[1*], Karma Nidup[2], Karma Chophel[3], Karma Dorji[4], Sonam Penjor[5], Sonam Tshewang[6], Tshelthrim Pelden[7], Kinley Dem[8]

[*1]Yebilaptsa Central School, Ministry of Education and Skills Development, Bhutan.
[2]Wanakha Central School, Ministry of Education and Skills Development, Bhutan.
[3]Darla Middle Secondary School, Ministry of Education and Skills Development, Bhutan
[4]Sherubgatshel Middle Secondary School, Ministry of Education and Skills Development, Bhutan.
[5]Panbari Middle Secondary School, Ministry of Education and Skills Development, Bhutan
[6]Nganglam Central School, Ministry of Education and Skills Development, Bhutan.
[7]Nganglam Middle Secondary School, Ministry of Education and Skills Development, Bhutan.
[8]Zhemgang Central School, Ministry of Education and Skills Development, Bhutan
*Corresponding Author

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Abstract— *Mining plays a key role in facelifting the economic status of the people of its catchment area and nation particularly for developing countries, and Bhutan is no exception. In Bhutan mining provides employment and livelihood to a good number of people. Nyoenpaling Chiwog under Phuntshopelri Gewog, Samtse has been an important mining site for limestone, and dolomite since a few decades ago and will be hereafter too. However, the contribution of mining activity to livelihood and development is unclear today. So, there is a need for a thorough study on the impact of mining in Nyoenpaling Chiwog. The objective of this paper is to document the impact of mining in mining catchment areas. The data were collected from mining site localities through a mixed-method research approach. The study reveals that local people are not very positive about having mining sites in their area. There is an indication that local people are not benefiting as expected. The responses of residents suggest that adequate infrastructure development like a paved transport network, safe drinking water, bridge, and river embankment could ease their living in the area. Therefore, the study aims to explore the possibility of addressing these issues by concerned stakeholders. Addressing these issues can have a greater positive impact on the livelihood of people living here.*

Keywords— Benefits, Challenges, Economic Welfare, Environment Impact, Mining.

I. INTRODUCTION

In recent years, there has been growing concern about mining activities' social, economic, and environmental impacts on the locality. The impact of mining on the locality has been a subject of research for decades, with numerous studies examining the environmental, social, and economic impacts of mining activities. The study focuses on the specific case of Nyoenpaling Chiwog, Bhutan, where mining activities have been increasing in recent years. The research aims to explore the impacts of mining on local communities and their livelihoods, as well as the potential effects on overall development in the region. The study utilized both qualitative and quantitative research methods, including interviews with residents and stakeholders' surveys, and data analysis was carried out. The study explored the potential benefits and drawbacks of mining for the local economy, environment, and social dynamics. The study also explores potential strategies for mitigating negative impacts and promoting sustainable development in the region.

One of the key findings of this research is that mining activities can have significant negative impacts on the environment, including soil erosion, water pollution, and air pollution. This research underscores the need for sustainable mining practices that take into consideration the long-term impacts of mining on the locality. The impact of mining on the locality is a

multifaceted issue that requires a comprehensive understanding of the social, economic, and environmental dimensions of mining activities.

1.1 Perception of the impact of mining

Bhutan has a huge richness of mineral resources, including coal, dolomite, limestone, slate, and copper. A thorough enough geological map of 33% of the country has been created, according to the 2017 Mineral Development Policy. Only 0.04% of the land is now exploited for mining. The sector, despite being relatively tiny, is expected to have a big impact on Bhutan's economic growth, and the government is committed to taking advantage of its untapped resources (Gyelmo, 2021). However, the nation's mining and quarrying industries are expanding, and there have been reports of negative effects on local people and the environment. Many people are increasingly worried about the consequences that have an adverse influence on local populations and the delicate alpine ecosystems (National Council, 2013)

Mining can have significant impacts on people's livelihoods and the standard of living in the surrounding communities. According to National Council Report (2018), mining and quarrying seem to be an economically lucrative business in Bhutan, the evidence of corporate income tax declared by the sample mines reveals that it is lucrative for some and not for others. These impacts can be both positive and negative, depending on a range of factors such as the scale and type of mining operation, the level of community involvement and consultation, and the regulatory and governance frameworks in place (Viveros, 2014). Mining can lead to the forced relocation of communities, resulting in the loss of homes, land, and livelihoods (Lawson & Bentil, 2013). This can have significant impacts on the social and economic well-being of affected communities, including loss of income, social networks, and cultural heritage (Matlaba et al., 2017). On the other hand, mining can also have positive impacts on livelihoods and the standard of living. However, it is important to note that the positive impacts of mining on livelihoods and the standard of living are not always guaranteed. In some cases, mining companies may fail to create local employment opportunities or provide adequate support for local development initiatives. There may also be unintended negative consequences, such as inflationary pressures and the displacement of small-scale agricultural and pastoralist communities (Plank et al., 2016).

Mining in Bhutan has been controversial due to concerns over its impact on the environment and the local communities. While mining activities have contributed to the country's economic growth, there are also concerns about the negative effects on the environment and the well-being of local communities. According to a study conducted by Yangka (2021), mining activities have caused environmental degradation and loss of biodiversity in several areas of the country. The study also found that mining activities have led to soil erosion, water pollution, and other environmental issues. Additionally, the study highlighted the negative impacts on the health and livelihoods of local communities, particularly those living near mining sites. Similarly study by Pollut (2018) in Ghana reveals that the majority of Ghana's mining communities have suffered from environmental degradation brought on by mining processes, including air and water pollution.

Furthermore, a report published by (Kuenga, 2017) also highlights the negative impact of mining on the environment and communities in Bhutan. The report notes that mining activities have resulted in the loss of fertile land, the destruction of forests, and the displacement of communities. The report also points out that there is a lack of proper regulations and monitoring mechanisms to ensure that mining activities are carried out in an environmentally sustainable and socially responsible manner. The study by Galay (2006) argues that mining can contribute to the country's economic growth, improve infrastructure development, and reduce dependence on foreign aid. It is perceived as an opportunity to leverage the country's mineral resources for economic diversification and poverty reduction. Despite these potential positive impacts, it is important to ensure that mining activities are conducted responsibly and sustainably to minimize negative impacts on people's livelihoods and standard of living and promote long-term development in mining communities.

1.2 Impact of Mining on employment opportunities

Mining activities can provide employment opportunities for local communities, particularly in areas with high unemployment rates (Walser, 2020). Mining companies often require a diverse range of skills, including engineering, geology, and environmental science, as well as a range of support services, such as catering, transportation, and security. This can lead to improved income levels and reduced poverty, as well as increased skills and training opportunities for local workers (Bebbington, 2018). Although mining companies in Bhutan do not seem to provide a permanent source of employment, the study revealed that 61% of the workforce is comprised of Bhutanese and half of that comes from local communities (National Council Report, 2018).

According to a report by the World Bank (2018) and UNDP (2018), mining can provide direct and indirect employment opportunities. Direct employment includes jobs in the mining industry such as miners, engineers, and geologists, while indirect employment includes jobs created in related industries such as transportation, manufacturing, and services. The report notes that in some regions, mining can be a major employer, with some mines employing thousands of people. However, the report also highlights that the employment benefits of mining can be limited in some cases. For example, the report of William Baah-Boateng (2018) states that mining operations may require specialized skills that are not available locally, leading to the need to import labour or bring in workers from other regions. In addition, automation and technological advancements in the mining industry may lead to a decrease in the number of jobs available.

1.3 Role of Mining on Infrastructural Development in the Community

Mining has been shown to play a significant role in the development of infrastructure in communities. Various studies have explored the relationship between mining and infrastructure development in communities. The study by Agbogidi and Okonjo (2018) examined the impact of mining on the development of infrastructure in the rural communities of Nigeria. The study found that mining activities have positive effects on the development of infrastructure in these communities, including the provision of roads, water supply, and electricity. Similarly, another study by Adjei and Yamoah (2018) explored the relationship between mining and infrastructure development in Ghana. The study found that mining has contributed significantly to the development of infrastructure in the country, including the provision of roads, hospitals, schools, and other public facilities.

In contrast, a study by Baffour-Kyei et al. (2021) examined the impact of mining on the development of infrastructure in rural communities in Ghana and found that although mining has contributed to the development of some infrastructure, it has also led to the degradation of existing infrastructure such as roads and water supply systems. Another study by Chun-Chao et al., (2019) examined the impact of mining on the development of infrastructure in China. The study found that mining activities have contributed significantly to the development of infrastructure in the country, including the provision of roads, railways, and power plants. Mining companies can contribute to local development through infrastructure development initiatives such as building schools, health clinics, and roads (Reed & Miranda, 2015). This can improve access to basic services and enhance the quality of life for communities. Many mining companies have adopted corporate social responsibility initiatives aimed at improving the social and economic well-being of communities affected by mining activities (Marutle, 2017). These initiatives can include education and training programs, health and safety initiatives, and support for small-scale enterprises. Therefore, the literature suggests that mining has a significant impact on the development of infrastructure in communities. However, the nature and extent of this impact vary depending on the location, type of mining activity, and the policies and regulations in place to manage the industry.

II. METHODOLOGY

2.1 Research Approach

The study employed a mixed methods research approach as it offers a better way of addressing the research problem than qualitative and quantitative in isolation. The research approaches are plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation (Creswell & Creswell, 2018). The strengths of one method overcome the limitations of another method. Hence, it validates its practice in the current context of the research to explore the impact of mining in Nyoenpaling Chiwog.

2.2 Research Design

To conduct this study a convergent mixed methods research design is seen as an appropriate design that can help to guide this study. According to Creswell & Creswell (2018), a convergent parallel mixed-methods design will simultaneously collect both quantitative and qualitative data, merge the data, and use the result to understand the problem investigated. Following this design, both forms of data were collected at the same time and then integrated the information in the interpretation of the overall results. Thus, this study was carried away using both quantitative survey questionnaires and qualitative interview questions simultaneously.

2.3 Target Population

A target population is a group of individuals or organizations from the population with some common defining characteristic that the researcher can identify and study (Creswell, 2014). The target population is the source of primary data to answer the

research questions. In this study, the target population was the household who were directly impacted by mining activities in their Chiwog.

2.4 Sampling Technique

Sampling is the process of selecting a representative group from the population for the study. Sampling is vital for research since it determines the accuracy of the research. Moreover, Palys (2015) iterated that there is no best sampling strategy because which is best will depend on the context in which researchers are working and the nature of their research question. Therefore, purposive random sampling was used. It is also known as judgmental sampling and a non-probability sampling technique used in research where the selection of participants is based on the researcher's judgment or knowledge of the population being studied. The researchers identified the participants who were representative of the population and then randomly selected from that group. This technique was used as the population was difficult to define and the research question was focused on a specific subgroup within the larger population.

2.5 Sample Size

The sample size was determined using purposive random sampling. According to Schumacher (2010), the sample size is a critical consideration when conducting and evaluating research. The sample size will be decided in such a manner to include relevant persons, even though not all will be expected as part of the sample (Simons, 2009). Trochim (2006) stated that the researcher must focus on purposive sampling since the researcher will sample with a purpose in mind and has one or more specific predefined groups based on the purpose of the research. The sample size is the group of participants in a study selected from the target population from which the researcher generalizes to the target population (Creswell, 2014). For this study, 62 households from the Nyeonpaling chiwog under Phuntshopelri Gewog was the sample size. These participants were directly impacted by the mining activities in their community.

2.6 Survey Questionnaire

In the quantitative phase, the survey questionnaire was used to collect data from the respondents. According to Trueman (2019), a survey questionnaire is a series of questions asked to individuals to obtain statistically useful information about a given topic. The quantitative data was collected using 30 questionnaires based on three themes. The tools were developed based on 6 Likert Scale Items. As per Joshi et al. (2015), the Likert scale is applied as one of the most fundamental and frequently used psychometric tools in educational and social sciences research. The Likert scale is a set of statements (items) offered for a real or hypothetical situation under study. Participants were asked to show their level of agreement (from strongly disagree to strongly agree) with the given statement (items) on a metric scale.

2.7 Semi-Structured Interview

An interview is one of the most prominent forms of qualitative data collection since it enables researchers to understand people's perceptions, meanings, and situations (Punch, 2015). Likewise, Cohen et al. (2007) iterated that an interview is a flexible tool for data collection enabling multisensory channels to be used. Semi-structured interviews were used for the collection of qualitative data. The interviews were conducted with 12 participants for the qualitative sample based on 8 semi-structured questions developed, and sub-questions were asked as necessary.

2.8 Data Analysis

Quantitative data collected was entered into Statistical Package for the Social Sciences-22 (SPSS 22) and cleaned for statistical analysis. Descriptive statistics (mean and standard deviation [SD]) are used to describe and summarize the findings. The Raw data gathered from the interview are transcribed, coded, and categorized into various themes for the interpretation of the qualitative component of the data. According to Turner (2018), qualitative data is often elusive to researchers. Transcripts allow one to capture original, nuanced responses from the respondents. You get their response naturally using their own words—not a summarized version in your notes (Turner, 2018).

III. RESULTS AND DISCUSSIONS

This chapter presents the result and discussion for the field trip topic: "The Impacts of Mining on Local Livelihood and Development in Nyoenpaling Chiwog under Phuntshopelri Gewog, Samtse". Both quantitative and qualitative result analyses are presented in this chapter. The quantitative result analysis was based on survey questionnaires collected from 62 participants.

The qualitative analysis was done based on the results obtained from 12 interviewed participants. The chapter presents the demographic profile of participants and a theme-wise analysis of data.

TABLE 1
DEMOGRAPHIC REPRESENTATION OF THE SURVEY PARTICIPANTS

Gender	Count	Percentage
Male	27	43.5
Female	35	56.5
Total	62	100

TABLE 2
DEMOGRAPHIC REPRESENTATION OF THE INTERVIEW PARTICIPANTS

Gender	Count	Percentage
Male	6	50
Female	6	50
Total	12	100

TABLE 3
PERCEPTION OF MINING

Perception of the impact of mining					
	N	**Mean**	**Std. Deviation**	**Level of Acceptance**	**%**
B1. Mining activities are the source of economic development in the community.	62	5.19	0.99	Highly Positive	86.5
B2. Mining activities have led to an increase in household income.	62	5.13	0.97	Positive	85.5
B3. It reduces income inequality in the community.	62	4.34	1.02	Positive	72.3
B4. Mining activities increase my consumption level due to higher income and purchasing power over the years.	62	4.58	0.88	Positive	76.3
B5. I noticed changes in the cost of living since the establishment of mining companies.	62	4.76	0.78	Positive	79.3
B6. The establishment of mining companies enhanced my standard of living over the years.	62	4.85	0.97	Positive	80.8
B7. Mining has led to many improvements in community development, such as infrastructure and social services.	62	4.89	1.04	Positive	81.5
B8. The local community supports the mining project.	62	4.19	1.32	Slightly positive	69.8
B9. Mining activities have environmental impacts, including air and water pollution, deforestation, and the destruction of natural habitats.	62	2.76	1.4	Slightly Negative	46
B10. The mining company has implemented effective measures to mitigate the negative impacts of mining on the environment.	62	3.94	1.23	Slightly Positive	65.7

Note: ***1.00 – 1.82=Highly Negative, 1.83 – 2.65=Negative, 2.66 – 3.48= Slightly Negative, 3.49 – 4.31= Slightly Positive, 4.32 – 5.14= Positive, 5.15 – 6.00 Highly Positive. Adapted from Pimentel (2019)***

The study aims to investigate the community's perception of mining activities in terms of economic, social, and environmental impacts, the impact of mining on employment opportunities, and the role of mining on infrastructural development. The study collected data from 62 respondents using a structured questionnaire and twelve interviews based on semi-structured. The data triangulation is done based on survey questionnaire responses, interviews, and literature review to get a holistic result. The key findings are presented in terms of the mean (M) scores and standard deviation (SD) for each perception statement, which help us measure how positively or negatively the community views the impact of mining activities.

The highest mean score in the quantitative dataset (Table 3) was found for statement B1, which indicates that the community perceives mining activities as a significant source of economic development. The mean score of (M = 5.19, SD = .99) suggests a highly positive perception and a remarkable 86.5% of the participants hold this view. This implies that the community generally believes that mining has brought about economic benefits and opportunities. Similarly, statement B2 reveals a positive perception, with a mean score of (M = 5.13, SD = .97) and 85.5% of participants agreeing that mining has led to an increase in household income. This is another indicator of the community's positive view of the economic impact of mining activities. Further, the qualitative data supports that mining activity positively impacts the community's economy as residents are employed in mining. For instance, participants (P1, 3, 4, 7 & 9) state that compared to past years communities have increased purchasing power and they reason mining activity as the source of income generation. This was evidenced through the field visit by the researchers. According to the National Council Report (2013), state that mining and quarrying seem to be an economically lucrative business in Bhutan. According to Galay (2006), mining can help the country's economic growth and infrastructure development and reduce reliance on foreign aid. It is viewed as an opportunity to use the country's mineral wealth to diversify the economy and reduce poverty.

On the other end of the spectrum, the lowest mean score was recorded for statement B9. Here, participants expressed concerns about the environmental impact of mining, with a mean score of (M = 2.76, SD = 1.140) suggesting a slightly negative perception. Nearly half of the respondents, 46%, are worried about issues such as air and water pollution, deforestation, and habitat destruction caused by mining. Most responses from qualitative data agree that due to mining activity, there is a lot of air pollution, noise pollution, and diversion in the flow of rivers especially in monsoon season due to the dumping of waste from mining. According to the 2013 assessment study, unlawful dirt dumping in rivers and ravines is a typical occurrence close to mining and quarrying operations (Gyelmo, 2021). It was observed on a field visit that the surroundings were full of dust in the afternoon hours. It was definite since mining in this particular area is open-cast mining. In Bhutan, only opencast mining is practiced because of the nature of the topography and mineral deposits (Norbu, 2013). Mining in Bhutan has been controversial due to concerns over its impact on the environment and the local communities. While mining activities have contributed to the country's economic growth, there are also concerns about the negative effects on the environment and the well-being of local communities. According to Yangka (2021) research, mining activities have resulted in environmental deterioration and biodiversity loss in numerous sections of the country. According to the study, mining activities have also resulted in soil erosion, water pollution, and other environmental difficulties. Furthermore, the study emphasized the harmful effects on local residents' health and livelihoods, particularly those living near mining operations. Similarly, Kuenga, (2017) also underlines the negative impact of mining on the environment and communities in Bhutan. According to the research, mining activities have resulted in the destruction of forests, the loss of agricultural land, and the displacement of communities. The report also highlights that there is a lack of effective rules and monitoring procedures in place to ensure that mining activities are carried out in an environmentally sustainable and socially responsible manner. Nevertheless, it was found that mining companies try to address these issues to their capacity like sprinkling water on dusty unpaved road networks and providing waste bins. But its impact is very minimal. However, it was learned that the mining company takes full responsibility for reclaiming the mining site once mining is completed. For instance, PCAL has reclaimed its previous mining site at Utari, and the regain of the environment was found positive during the field visit.

The current study explores the community's opinion of mining activities in terms of their economic, social, and environmental consequences. According to the findings, the community has a positive impression of mining's economic and social consequences, but a negative perception of its environmental impact. The study also suggests that the mining company needs to implement more effective measures to mitigate the negative impacts of mining on the environment. Other concerned

stakeholders can also play an important role in formulating valuable measures to bring positive change on the impact of the environment.

TABLE 4
IMPACT OF MINING ON EMPLOYMENT OPPORTUNITIES

Impact of Mining companies on Employment Opportunities					
	N	**Mean**	**Std. Deviation**	**Level of Acceptance**	**%**
C1. Mining has contributed to the growth of the local economy through business opportunities.	62	4.92	0.93	Positive	82
C2. Mining has contributed to the creation of several job opportunities in the business sector.	62	5.27	0.96	Highly Positive	88
C3. It led to a significant increase in employment opportunities for the local community.	62	5.29	0.97	Highly positive	88
C4. There is no issue of unemployment in the community	62	4.5	1.07	Positive	75
C5. Local resident prefers to work in the mining as they can earn more income.	62	5.1	0.74	Positive	85
C6. Working in the mining industry is only the source of income for the people in the community.	62	5.11	0.83	Positive	85
C7. The mining companies recruit more residents than others.	62	4.52	0.88	Positive	75
C8. The mining company has collaborated with local government and community organizations to support employment opportunities.	62	4.32	0.9	Positive	72
C9. The mining company has respected workers' rights and provided safe working conditions.	62	4.95	0.86	Positive	83
C10. The mining company has provided training and skill development programs for the local workforce.	62	4.74	0.96	Positive	79

The analysis of both quantitative and qualitative data in Theme 2 (Table 4), " Impact of mining companies on employment opportunities," provides valuable insights into how communities perceive the potential impact of mining on employment opportunities offered by two mining (PCAL & SMCL) company. The findings reveal that communities hold positive perceptions regarding on employment opportunities. Notably, item C3, which suggests that the community overwhelmingly perceive mining as a significant contributor to employment opportunities with mean score (M = 5.29, SD = .97) and was rated as highly positive by 88.2% of respondents. This indicates that the majority of the community believes that mining activities have led to a substantial increase in employment opportunities, which is a crucial aspect of local economic growth. C2 closely follows as the second-highest rated statement, with a mean score of (M = 5.27, SD = .96) and 87.8% of participants expressing highly positive sentiments. This finding underscores the community's strong belief that mining has not only created jobs but also contributed to the expansion of opportunities in the local business sector. In the absence of a different labour force mining cannot be carried out. In employing labour preference is given to affected community. According to Subba (2020), the National Assembly enacted a new clause in the Mines and Minerals Bill 2020 requiring at least 30% of job possibilities to be supplied to members of the local community. According to NSB (2022) mining and quarrying alone has given employment to 1446 who are primarily in mining. Further mining activities also create employment opportunities in business, transport system and many more in manufacturing unit. The qualitative study also reveals that mining companies have employed good numbers of labours from the community especially the low-skilled in the mining site. In the interview, a few respondents stated that “70% of labours are employees from the local community.” However, the qualitative study (P3, 4, 7, 10 &12) reveals that there are unemployment issues in the community. Further, the study reveals that most skilled labourers are from other parts of the country. According to Subba (2020) Pugli spokesperson in the television justify that , just approximately 10% of the job chances are allocated to local citizens. "However, the majority of those employment are blue-collar. "People from the community do not get jobs at the supervisory levels," The rationale behind can be mining activity requires different skilled labour, and mining company might have faced shortage of required skilled labour from particular community hence left with no option rather than looking from other locations.

Conversely, the lowest mean score was observed for statement C8, which suggests that the community's perception of collaboration between the mining company, local government, and community organizations to support employment opportunities is less positive. The mean score (M = 4.32, SD = .90) and 72% of participants holding a positive view indicate that while the majority see positive collaboration, there's room for improvement in this area. The majority of qualitative responses share similar opinions (P1, 3, 5, 6, 7, 9, 11, & 12) that strong collaboration among communities, mining companies, and other relevant stakeholders can have better implications and other advantages for the community. There is room for enhancing collaboration between the mining company, local authorities, and community organizations to further improve employment opportunities and support for the workforce.

TABLE 5
ROLE OF MINING ON INTRACULTURAL DEVELOPMENT

Role of Mining on Infrastructural Development in the Community					
	N	**Mean**	**Std. Deviation**	**Level of Acceptance**	**%**
D1. Mining plays a critical role in improving the quality of infrastructure in local communities.	62	4.69	1.21	Positive	78
D2. Mining helps in developing better communication facilities in the community.	62	4.63	1.15	Positive	77
D3. The residents are enjoying better road facilities.	62	4.02	1.45	Slightly Positive	67
D4. People are accessible to better health facilities.	62	4.11	1.19	Slightly Positive	69
D5. People are accessible to better education facilities for their children in the community.	62	4.68	0.92	Positive	78
D6. People are accessible to better banking services.	62	4.48	0.99	Positive	75
D7. People are provided with adequate and safe drinking water facilities.	62	4.18	1.57	Slightly Positive	70
D8. The mining company has contributed to the development of local roads and transportation systems.	62	4.52	1.18	Positive	75
D9. Local communities are enjoying a better power supply.	62	4.84	0.89	Positive	81
D10. The mining company has contributed to the development of local emergency services and disaster response systems.	62	4.39	1.05	Positive	73

Table 4 presents quantitative data on the role of mining on infrastructural development in the community. These findings offer a numerical perspective mean and standard deviation ranging from (M = 4.02, SD = 1.45) lowest to mean (M = 4.84, SD = .89) highest. Overall the table indicates the positive level of acceptance. This suggests that, on average, respondents perceive mining has led to certain development of infrastructures in the community.

The highest mean score was recorded for statement D9. This statement indicates that the community overwhelmingly believes that mining has contributed to improved power supply, with a mean score of (M = 4.84, SD = .89). An impressive 80.7% of participants express a positive view in this regard. This suggests that most of the community feels that mining activities have positively impacted access to reliable power, which is a vital component of infrastructure development. Similarly, D1, with a mean score (M = 4.69, SD = 1.21) with 78.2% of participants holding a positive view. This statement highlights the community's belief that mining plays a critical role in enhancing the quality of local infrastructure, emphasizing the positive impact on various aspects of community life. Proper road network and power supply are a must in mining. These are the basic infrastructures to function in mining activity smoothly. The qualitative analysis also supports the fact that the area contains essential amenities such as roads, schools, and health care, which assist the local community indirectly. Adjei and Yamoah (2018) investigated the relationship between mining and infrastructure development in Ghana. According to the research, mining has substantially contributed in the construction of the nation's infrastructure, which includes highways, hospitals,

schools, and other public structures. Similarly, according to Agbogidi and Okonjo's (2018) mining research in Nigeria, the mining business has a positive impact on the development of local infrastructure such as roads, water supplies, and power.

However, statement D3 (The residents are enjoying better road facilities). This statement suggests that the community's perception of improved road facilities is less positive, with a mean score of (M = 4.02, SD = 1.45) with 67% of participants expressing a slightly positive view. This indicates that while the community acknowledges some positive changes in road infrastructure, there is room for further improvements. The field visit findings reveal the same. It was found that road conditions were not smooth at all. Roads were full of potholes, bumpy and dusty. Hundreds of heavily loaded trucks playing daily on the road could have caused damage. Communities impacted by mining activities claim that there is no advantage to mining in their communities, while the consequences threaten their livelihood and health (Subba, 2020). He further stated a representative from Samdrupjongkhar's Phuntshothang hamlet stated that excavation activities had impacted their water sources and crop output. According to him, farmers were only able to harvest roughly 50kg of paddy from a field that used to produce about 300kg. A similar view was shared by a representative of the afflicted Nyoepaling community, who expressed similar concerns. He claimed that large and heavy vehicles were a major issue on the roadways and caused dust. "There should be more tankers to sprinkle water on the road to reduce the dust problem." This was further supported by a qualitative study where participants stated,“Road conditions are not that good and it turns bad during the summer season owing to heavy rainfall. Moreover, there is no proper drainage and is full of dust.”

These findings underscore the community's belief that mining has had a positive impact on various aspects of infrastructure development, such as power supply, overall infrastructure quality, and improved communication facilities. However, it is also important to note that the community's perception of road facilities needs more attention and improvements. The study findings emphasize the multifaceted role of mining in influencing infrastructure development within a community. It underscores the need for mining companies and local authorities to work together to address infrastructure challenges and further enhance the positive impact on community well-being. These community perspectives are invaluable in assessing the holistic effects of mining activities on local development.

IV. CONCLUSION

Mining activity in the Nyoenpaling community has both negative and positive impacts. While mining has provided employment opportunities and increased economic growth as well as the development of infrastructure in communities, it has also caused environmental degradation, air pollution, land pollution, and social disruptions. It is important for stakeholders to carefully consider these impacts and implement measures to minimize negative consequences while maximizing the positive ones. However, the benefits of mining must be carefully balanced against its potential negative impacts, and it is important to ensure that mining activities are conducted in a way that minimizes harm to the environment and respects the rights of local communities. Overall, the impact of mining on local livelihoods is a complex and challenging issue that requires a multidisciplinary and collaborative approach. By working together, governments, communities, and mining companies can ensure that mining activities are conducted in a way that respects human rights, protects the environment, and supports sustainable economic development. This will require ongoing monitoring, evaluation, and adaptation of policies and practices to ensure that the benefits of mining are maximized while its negative impacts are minimized. The study findings recommend the following points for sustainable mining with minimum impact on local communities.

1. Mining companies may engage with local communities and involve them in the decision-making process. Community engagement should be an ongoing process that includes regular consultations and open communication channels.
2. Mining projects may prioritize local employment and provide opportunities for skills development and training. This can help enhance the livelihoods of community members by creating job opportunities and building their capacity to participate in the mining industry or other sectors.
3. Mining companies may promote local economic development by creating job opportunities for local residents, supporting local businesses, and investing in local infrastructure development.
4. Mining companies may conduct regular environmental and social impact assessments to monitor the effects of mining on the local environment and communities.
5. Mining companies may contribute to the development of social infrastructure like healthcare facilities, education, transportation, and other essential amenities that can improve the livelihood of the community.

REFERENCES

[1] Adjei, & Yamoah. (2018). *Shared Use of Mining-Related Infrastructure (Rail, Port, Power, Water, and ICT) | Columbia Center on Sustainable Investment*. Ccsi.columbia.edu. https://ccsi.columbia.edu/content/leveraging-mining-related-infrastructure-investments-development-rails-port-power-water-and

[2] Agbogidi, & Okonjo. (2018). *LOCAL COMMUNITIES AND MINES 198 Sustainable Development at the Community Level 200 Gains and Losses at the Local Level*. https://www.iied.org/sites/default/files/pdfs/migrate/G00901.pdf

[3] Baffour-Kyei, V., Mensah, A., Owusu, V., & Horlu, G. S. A. K. (2021). Artisanal small-scale mining and livelihood assets in rural southern Ghana. *Resources Policy*, *71*(651), 101988. https://doi.org/10.1016/j.resourpol.2021.101988

[4] Bebbington. (2019). *Mining industry employment and talent challenges | McKinsey*. Www.mckinsey.com. https://www.mckinsey.com/industries/metals-and-mining/our-insights/has-mining-lost-its-luster-why-talent-is-moving-elsewhere-and-how-to-bring-them-back

[5] Chun-Chao, W., Yu, H., Huang, J., Wang, W.-S., Faruquee, M., Zhang, F., Zhao, X.-Q., Fu, B.-Y., Chen, K., Zhang, H.-L., Tai, S.-S., Wei, C., McNally, K. L., Alexandrov, N., Gao, X.-Y., Li, J., Li, Z.-K., Xu, J.-L., & Zheng, T.-Q. (2019). Towards a deeper haplotype mining of complex traits in rice with RFGB v2.0. *Plant Biotechnology Journal*, *18*(1), 14–16. https://doi.org/10.1111/pbi.13215

[6] Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education*. https://gtu.ge/Agro-Lib/RESEARCH%20METHOD%20COHEN%20ok.pdf

[7] Creswell, & Creswell. (2018). *APA PsycNet*. Psycnet.apa.org. https://psycnet.apa.org/doiLanding?doi=10.1037%2Famp0000151

[8] Creswell, J. W. (2014). *Creswell, J. W. (2014). Research Design Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA Sage. - References - Scientific Research Publishing*. Scirp.org. https://www.scirp.org/(S(i43dyn45teexjx455qlt3d2q))/reference/ReferencesPapers.aspx?ReferenceID=1964849

[9] Gyelmo, D. (2021). What is the cost of Bhutan's mining boom? The Third Pole.

[10] Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015, January). *(PDF) Likert Scale: Explored and Explained*. ResearchGate. https://www.researchgate.net/publication/276394797_Likert_Scale_Explored_and_Explained

[11] Kalu. (2021). *Use of computer softwares and geomatic techniques for reclamation study of environmentally degraded mined lands in Benin City, Nigeria*. Scholar.google.com. https://scholar.google.com/citations?view_op=view_citation&hl=en&user=55i1Uu0AAAAJ&citation_for_view=55i1Uu0AAAAJ:u-x6o8ySG0sC

[12] Konte, M., & Vincent, R. C. (2020). Mining and the Quality of Public Services. *Openknowledge.worldbank.org*. https://doi.org/10.1596/1813-9450-9385

[13] Kuenga. (2017). *Mining has great economic potential for Bhutan*. The Bhutanese. https://thebhutanese.bt/mining-has-great-economic-potential-for-bhutan/

[14] Lawson, E. T., & Bentil, G. (2013). Shifting sands: changes in community perceptions of mining in Ghana. *Environment, Development and Sustainability*, *16*(1), 217–238. https://doi.org/10.1007/s10668-013-9472-y

[15] Leuenberger, A., Winkler, M. S., Cambaco, O., Cossa, H., Kihwele, F., Lyatuu, I., Zabré, H. R., Farnham, A., Macete, E., & Munguambe, K. (2021). Health impacts of industrial mining on surrounding communities: Local perspectives from three sub-Saharan African countries. *PLOS ONE*, *16*(6), e0252433. https://doi.org/10.1371/journal.pone.0252433

[16] Marutle, O. W., & Daw, O. D. (2017). The Significance of Mining Infrastructural Development on South African Economy from 1980-2013: An Econometric Approach. *Journal of Economics and Behavioral Studies*, *9*(3), 73–81. https://ideas.repec.org/a/rnd/arjebs/v9y2017i3p73-81.html

[17] Matlaba, V. J., Mota, J. A., Maneschy, M. C., & Filipe dos Santos, J. (2017). Social perception at the onset of a mining development in Eastern Amazonia, Brazil. *Resources Policy*, *54*(235), 157–166. https://doi.org/10.1016/j.resourpol.2017.09.012

[18] National Council of Bhutan (2013). Socio-economic and environmental impact assessment of mining and quarrying activities in Bhutan

[19] National Statistics Bureau (2022). 2022 labour force survey report of Bhutan

[20] Norbu, D. (2013). Mining has great economic potential for Bhutan. The Bhutanese

[21] Palys, T. (2015). *Purposive sampling*. https://www.sfu.ca/~palys/Purposive%20sampling.pdf

[22] Pimentel, J. L. (2019). A note on the usage of Likert Scaling for research data analysis. USM R&D Journal, 18(2), 109-112, https://www.researchgate.net/profile/Jonald-Pimentel/publication/331231816.

[23] Pollut, J. H. (2018). Review of Environmental and Health of mining in Ghana. National Library of Medicine

[24] Punch. (2015). *Punch, K. (2005) Introduction to Social Research Quantitative and Qualitative Approaches. 2nd Edition, Sage, London. - References - Scientific Research Publishing*. Scirp.org. https://www.scirp.org/%28S%28vtj3fa45qm1ean45vvffcz55%29%29/reference/referencespapers.aspx?referenceid=1568794

[25] Rahnema, M., Amirmoeini, B., & Moradi Afrapoli, A. (2022). Incorporating Environmental Impacts into Short-Term Mine Planning: A Literature Survey. *Mining*, *3*(1), 163–175. https://doi.org/10.3390/mining3010010

[26] Reed, E., & Miranda, M. (2015). *Assessment of the Mining Sector and Infrastructure Development in the Congo Basin Region*. http://awsassets.panda.org/downloads/congobasinmining.pdf

[27] Salles, D. M., Carmo, F. F. do, & Jacobi, C. M. (2018). Habitat Loss Challenges the Conservation of Endemic Plants in Mining-Targeted Brazilian Mountains. *Environmental Conservation*, *46*(02), 140–146. https://doi.org/10.1017/s0376892918000401

[28] Simon. H. (2009). *Case Study Research in Practice. London Sage. - References - Scientific Research Publishing*. Www.scirp.org. https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/referencespapers.aspx?referenceid=1765011

[29] Schumacher, H. J. (2010). *Research in Education: Evidence-Based Inquiry, 7th Edition. MyEducationLab Series.* Pearson; Pearson. One Lake Street, Upper Saddle River, New Jersey 07458. Tel: 800-848-9500; Web site: http://www.pearsoned.com/. https://eric.ed.gov/?id=ED577250

[30] Subba, M. B. (2020) Assembly proposes reserving 30% mining job to communities. Kuensel

[31] Subba, M. B. (2020). Communities say not much benefit from mining. Kuensel

[32] Trochim, A. L. (2006). *Trochim, W. M. K. (2006). The Qualitative Debate. Research Methods Knowledge Base. - References - Scientific Research Publishing*. Www.scirp.org. https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1731964

[33] Turner, D. (2018, April 26). *Quantitative vs. qualitative research*. Quirkos Qualitative Research Blog. https://www.quirkos.com/blog/post/quantitative-vs-qualitative-research/

[34] United Nation Development Programme (2018). Managing mining for sustainable development. A Sourcebook.

[35] Van der Plank, S., Walsh, B., & Behrens, P. (2016). The expected impacts of mining: Stakeholder perceptions of a proposed mineral sands mine in rural Australia. *Resources Policy*, *48*(34), 129–136. https://doi.org/10.1016/j.resourpol.2016.03.005

[36] Viveros, H. (2014). Examining Stakeholders' Perceptions of Mining Impacts and Corporate Social Responsibility. *Corporate Social Responsibility and Environmental Management*, *23*(1), 50–64. https://doi.org/10.1002/csr.1363

[37] Walser, G. (2020). *Economic impact of world mining*. https://inis.iaea.org/collection/NCLCollectionStore/_Public/33/032/33032900.pdf

[38] William Baah-Boateng, P. (2018). *Job creation in the mining sector: evidence from Ghana*. https://unctad.org/system/files/non-official-document/GCF2018_BaahBoateng_23042018.pdf

[39] World Bank. (2018). *Climate-Smart Mining: Minerals for Climate Action*. World Bank. https://www.worldbank.org/en/news/infographic/2019/02/26/climate-smart-mining

[40] Yangka ·. (2021, June 29). *What is the cost of Bhutan's mining boom?* The Third Pole. https://www.thethirdpole.net/en/pollution/what-is-the-cost-of-bhutans-mining-boom/