Changes in livelihoods: coastal community responses to artisanal gold mining at Anggai village

F D Salim¹, Ma'sitasari¹, N A Damsiki², and Y Abubakar¹

¹Fisheries and Marine Science Faculty, Khairun University, Gambesi Campus II, Ternate City, Indonesia
²Marine Science, Nuku University, Tidore Islands City, Indonesia

E-mail: fjrslm3@gmail.com

Abstract: This study aims to describe changes in the livelihoods of coastal communities in Anggai village as a response to artisanal gold mining. The study used a descriptive approach the selection of respondents by purposive sampling. The results showed a change in the livelihood pattern, marked by a change in job orientation shifting work orientation from being farmers/fishers as the primary/main livelihood to being miners. Internal factors driving the change were individual motivation, work duration, and offspring needs. Meanwhile, external factors included job opportunities offered/invited by relatives, simple technology that was easy to apply, and growing mobilization. Meanwhile, artisanal mining had impact in increasing community (family) income.

1. Introduction

For several decades, artisanal gold mining has become a worldwide concern because of use of mercury, unique problem of poverty and health, and environmental impacts [1]. However, on the other hand, it also provides livelihood opportunities for many people [2]. Artisanal gold mining is widely spread in developing countries [3]. At least more than 100 million people are spread over 55 countries, the livelihoods of the people depend on this mining, including Africa, South America, Indonesia, and the Philippines [4]. Artisanal gold mining produces 20-30% of the world's gold production or about 500-800 tons per year. This mining activity involves about 10-15 million miners, including 4.5 million women and 1 million children [1].

Indonesia is one of the developing countries, which has coastal and marine resources and abundant mineral resources in the form of gold. [5]. It is recorded that there are 115 artisanal gold mines spread evenly all over Indonesia with total production of 60 tons of gold per year [6]. The number of miners reached more than 250,000 people [7]. Artisanal gold mining in Indonesia is not a new phenomenon; it has existed since the Dutch colonial era [8]. This sector is in great demand by rural communities in Indonesia. One reason is that this sector is more promising from an economic perspective than other sectors [9]. Artisanal gold mining is also found in North Maluku [8], [10]. In contrast to artisanal gold mining in other areas, the locations of community gold mining in North Maluku are generally located in coastal areas near the coast. This study focuses on community gold mining in Anggai village, Obi district, southern Halmahera district, North Maluku province. Besides being on the coast near the coast, the gold mining location is also only ± 1-2 km from residential areas.

Anggai Village, a coastal village that has fishery and agricultural potential, also has the potential for mineral resources in the form of gold, which is estimated to have an area of > 100 ha. Gold mining in this village has been managed by the community with an area of ± 25 ha [11]. The mine has been...
active since 1995. Currently, it is estimated that there are more than 100 groups of active miners. The existence of this community of gold mining has brought changes to the socio-economic conditions of coastal communities in Anggai village. One of the social aspects that have changed is the community's livelihood.

Economic difficulties and the drive for a better life have made local people in Anggai village become miners. The community has slowly abandoned their old habits; even most of their agricultural land has been converted into mining land and residential land in gold mining areas. The same condition applies to some local fishermen; they have not gone to sea for a long time because they focus on being miners. Another thing is the migration of people from various regions who come, either as miners or for other business opportunities, namely trading, workshop businesses, fish traders, boarding houses, and others. Thus, community gold mining has influenced the dynamics and aspects of the life of coastal communities in Anggai village.

Changes in livelihoods, including shifts in work orientation, are essential to study because these changes positively impact and hurt the livelihood systems of coastal communities, especially local communities in Anggai village. This study has been focusing on exploring patterns and factors causing changes in livelihoods as a community response to smallholder gold mining and the implications of these changes on local artisanal income.

2. Research method
This research is research with a descriptive approach, a research design that seeks to find general information about a problem that has not been fully understood by researchers and describes it without analyzing and making conclusions that apply to the public [12]. This research took place in Anggai Village, Obi District South Halmahera Regency North Maluku Province. Research subjects were determined and selected using the purposive sampling technique. The selected sample is households, both residents and immigrants, who live in residential areas or mining sites, carry out mining activities during the research, and have other businesses supporting mining activities. The sample amounted to 87 households consisting of 54 residents, 13 families of immigrants from the surrounding villages, 20 families of migrants from other areas.

Research data in the form of primary data obtained from observations, interviews with questionnaires, and secondary data related to the literature study on the results of previous research and sources relevant to the research obtained from the village office and other agencies that support research. Primary data consists of data on the characteristics of respondents, livelihoods before and after being involved in mining, mining activities, and income. Data collection with interview techniques using questionnaires was carried out by researchers face-to-face to obtain answers by the respondent's condition. The data in this study were analyzed using descriptive statistical analysis, which only provides an overview of the phenomenon without providing conclusions for generalization purposes [12] presentation of data in the form of tables, percentages, and diagrams.

3. Result and discussion
3.1. Mining activities, job opportunities, and wage system
The artisanal gold mining in Anggai village has been operating for ± 24 years. Before the community managed this mining, it was first opened and managed by a company [11]. There are three mining areas: the old location, the central location, and the new location. The area of these three mining sites is ± 25 ha [11]. As a source of livelihood for local communities, this mining is generally carried out on a relatively small scale with relatively minimal involvement of knowledge and technology.

The mining system in Anggai village uses an underground mining system, namely by making tunnels and wells. Holes are dug using simple manual equipment, sometimes up to a depth of 70 meters with a tunnel length of up to ± 200 meters. The stone material and quartz veins obtained are then lifted to the surface, then crushed using hammers weighing 5 kg and 10 kg to produce material the size of gravel, followed by the process of amalgamation. The material is put in a drum (drum) and
then rotated with the help of a drum driving machine. For 2.5 hours, the material became sand powder and then added 0.5 kg of mercury/trammel and water as the mixing medium. The next step is to rotate the coils for ± 30 minutes. The mixture is amalgam removed from the coil while being washed, sprayed with water. The mercury-gold mixture that has been cleaned of mud and sand is separated with a parachute cloth to separate the gold from the mercury. The last stage of this process is to get pure gold through a burning process for ± 15 minutes. In addition to the process amalgamation, the remaining waste from the drum that has been accommodated in ponds then processed again is put into a large container resembling a tube, the chemicals used are cyanide, activated carbon, lime, then stirred for ± 2 hours then filtered. The finely filtered material is heated in a tubular combustion vessel to produce pure gold.

The miners are generally local people and the surrounding villages who work in groups, wherein in each group, there is a systematic division of labor tasks. There are also miners from outside the region, including Sulawesi and Java, some of whom are business owners/capital owners. Only a few local people become business owners. This is due to limited capital, low mining technical capabilities, and an understanding of appropriate environmental standards. Recruitment of workers in a production unit usually has loose or unbound work ties. This means that workers can work in more than one production business. Usually, the workers still have kinship/brotherhood ties with the business owner. The division of labor that applies includes workers who are tasked with digging holes, making tunnels, and looking for lumps of material/quartz veins; the worker in charge of carrying the material from the tunnel to the production house is called a "deer"; workers who crush material into pebbles are called "rempel"; workers who operate drums, and business owners. Each group consists of 5-10 miners.

The wage system for mining workers varies according to the division of labor. Generally, two wage systems apply, namely cash wages and non-cash wages. According to the material obtained, cash wages are given by business owners in the form of cash and non-cash wages in the form of profit-sharing. For example, miners in charge of digging holes/finding gold deposits in tunnels generally apply non-cash wages in the distribution of 10:2 (10 chunks for business owners and two chunks for hole diggers). Different wage systems have different incomes earned by miners, but generally, the amount of income they get from gold mining activities is much more significant in a relatively short period compared to the income they get from plantation products or selling marine products.

In addition to work from mining activities, there are also business opportunities from non-mining activities, namely food traders, clothing traders, food stalls at mining sites, housing rental services, mining equipment workshop services, mining equipment providers, traveling fish traders, rental cars, motorcycle taxis, and other businesses. The opening of job opportunities and business opportunities in the area around mining has a positive impact on the community's socio-economic life and villages. This can be seen from the improvement in the physical assets of local communities such as houses, ownership of motorized vehicles, and other assets. In addition, additional village PAD comes from fees imposed by the village government to mining business owners for village development. The opening of access to land roads and plantation roads is a benefit that is now felt by the community at this time. The economic benefits felt by the local community have become a driving factor for the shift in livelihoods or livelihood orientation by no longer depending on agricultural and fishery products.

3.2. Community livelihoods before and after artisanal gold mining

Changes in livelihoods are changes in the main livelihood of individuals/households due to certain reasons that are motivated to get a better life than before [13]. The following are the livelihoods of the coastal communities of Anggai village before and after the artisanal gold mine.

Table 1 shows that there has been a change in the livelihood patterns of both local and migrant communities in Anggai village. These changes are both in the primary and side livelihoods. Before gold mining, most husbands (heads of families) were farmers, namely 73.6%; when there was a gold mine, there was a shift in the orientation of the prominent livelihood from farmers to miners (75.9%). Likewise, the side income of the head of the family/husband. Previously, the head of the family did not have a side job, but after the gold mine, farming activities were a side job for some
people. Apart from the husband, the family's economic structure is also obtained from the wife's income. Before the artisanal gold mine, wives were only housewives. However, after the mining, some wives were involved in mining activities.

Table 1. Livelihood husband and wife before and after gold mine people

| Categories livelihood | Percentage categories livelihood (%) | Before | After | Before | After | Before | After | Before | After | Before | After |
|-----------------------|--------------------------------------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Not Working           | 3.4                                  | 0      | -     | -      | -     | -      | -     | -      | -     | -      | -     |
| Fishermen             | 11.5                                 | 13.8   | 21.8  | -      | -     | -      | -     | -      | -     | -      | -     |
| Farmers               | 73.6                                 | 4.6    | 9.2   | 60.9   | -     | -      | -     | -      | -     | -      | -     |
| Agricultural Laborers | -                                    | -      | -     | -      | -     | -      | -     | -      | -     | -      | -     |
| Fishermen Workers     | -                                    | -      | -     | -      | -     | -      | -     | -      | -     | -      | -     |
| Traders               | 4.6                                  | 2.3    | -     | -      | -     | -      | -     | -      | -     | 5.7    | 6.9   |
| Civil Servants        | -                                    | -      | -     | -      | -     | -      | -     | -      | -     | -      | -     |
| Housewife             | -                                    | -      | -     | -      | -     | -      | -     | -      | -     | 100    | 88.5  |
| Worker Construction   | 4.6                                  | 0      | 9.2   | -      | -     | -      | -     | -      | -     | -      | -     |
| Miner                 | 0                                    | 75.9   | -     | 21.8   | -     | 11.5   | -     | 71.3   | -     | -      | -     |
| No side job           | -                                    | -      | 59.8  | 15     | -     | -      | -     | 94.3   | -     | -      | -     |
| Others                | 2.3                                  | 3.4    | -     | 2.3    | -     | -      | -     | -      | -     | -      | -     |
| Total (%)             | 100                                  | 100    | 100   | 100    | 100   | 100    | 100   | 100    | 100   | 100    | 100   |

The study results also show that most family heads (husbands), both residents and migrants, do not have side jobs. However, the conditions are different when post-mining, where a farmer occupies the top position. This indicates a change in livelihood patterns, especially the main livelihood pattern, namely from farming/fishing to being a miner and other business actors in the mining sector. Although the main profession has changed, those who own agricultural/plantation areas still carry out farming activities in their spare time.

3.3. Livelihood and income

This change in livelihood is marked by a change in the orientation of the community's livelihood. This causes the level of income to change [13]. The following shows the level of income based on the occupation of coastal communities before and after the community gold mining (Table 2).

Table 2 shows that the income level before and after their husband's gold mining has changed at the change of livelihood. Before gold mining, the majority of the people were farmers whose incomes ranged from Rp.500.000 to Rp.1.000.000/-/month. The income range is mostly obtained from agricultural/plantation products. After artisanal gold mining, the income level of the majority of the community ranges from Rp.1.000.000 - to Rp.5.000.000 -/month. The range of income earned comes from wages earned as miners and their agricultural/plantation products.

The presence of artisanal gold mining in Anggai village can create job opportunities and increase income, especially for local communities. The increase in income was caused by income as a miner and population growth from the mobilization of migrants to create markets and other business opportunities. However, there are concerns about other consequences that local communities will face when gold mining activities end. The transfer of land use for mining and dependence on mining also
have negative consequences that must be faced in the future. This condition is exacerbated if the local artisanal lifestyle is consumptive. The interview results show that the local community's dependence on this community's gold mining is so high that they choose to remain as miners even though they have to go to other mining areas if the mining potential in their area has been exhausted.

| Table 2. Cross-tabulation of family income and main/side job before and after artisanal gold mining |
| Income (Rp/month) | Type of husband's occupation | Before artisanal gold mining |
|                  | Not Working | Fisher man | Farmer | Trader | Construction Workers | Other | Total |
| No Income        | U S U S U S | U S U S U S | U S U S U S | 52 107 |
| 500.000 - 1.000.000 | - - 7 62 8 4 | - - 4 8 2 | - - - | - - - |
| > 1.000.000 - 3.000.000 | - - 3 3 | - - - | - - - | - - - |
| > 3.000.000 - 5.000.000 | - - 1 1 | - - - | - - - | - - - |
| > 5.000.000 | - - - - | - - - | - - - | - - - |

| Income (Rp/month) | Husband's type of work | After gold mining, people |
|                  | Not working | Fisherman | Farmer | Trader | Miners | Other | Total |
| No Income        | U S U S | 13 3 11 | 2 16 | 62 |
| 500.000 - 1.000.000 | - - - | 3 11 | 2 - | 66 |
| > 1.000.000 - 3.000.000 | - - 1 1 | 1 47 | 3 - | 13 |
| > 3.000.000 - 5.000.000 | - - 2 | - 36 | 16 10 | 66 |
| > 5.000.000 | - - - | 5 2 | 1 5 - | 13 |

| Income (Rp/month) | Wife's type of work | Before | After |
|                  | House wife | Traders | Total | House wife | Miners | Traders | Total |
| No Income        | 87 78 82 | - - - | 160 | 87 6 2 | 3 3 | - | 8 |
| 500.000 - 1.000.000 | - - - | 0 - | 8 | - - | - 3 | 6 | 6 |
| > 1.000.000 - 3.000.000 | - - - | 0 - | 3 | - - | - - | 0 | 0 |
| > 3.000.000 - 5.000.000 | - - - | 0 - | 0 | - - | - - | 0 | 0 |

Description: N = 87 sample; N = Primary of livelihood; S = secondary of livelihood

4. Conclusion
The presence of community gold mining in Anggai village has brought changes to the coastal communities in the village. These changes are changes in livelihood patterns, especially for local
communities. Changes in the livelihood patterns of local communities are marked by a shift in the orientation of the main livelihood from agrarian to non-agricultural, from farmers/fishers to miners. The causative factors include earning a better income than before, improving the family's standard of living, and encouragement to improve the quality of life for future generations, including providing better education for children. The implications of changing livelihoods can be seen from the increase in community income.

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