



The Valuation Mangrove Forest Economy of Community Development Program of Badak LNG

Busori Sunaryo^{1✉}, Reta Yudistyana², Akhmad Taufiq Firdy³

PT Badak NGL, Indonesia

Article Info

Article History:
Received January 2018
Accepted March 2018
Published May 2018

Keywords:
*Economic Valuation,
Mangrove, Mangrove Crab,
Mangrove Seedling, CSR of
Badak LNG*

Abstract

Mangrove forest is one of the resources that has important functions and roles in a single ecosystem. The utilization of mangrove forest also has a fairly high economic value. The existence of mangrove forest has several functions such as a media for mangrove crab cultivation, mangrove cultivation, diversification of mangrove products and mangrove tourism. Some of these benefits were introduced by CSR of Badak LNG program to society around the mangrove forest in Bontang City for the economic improvement of coastal communities by exploiting the existing mangrove potential. Thus, the aim of this study is to calculate the economic value of the utilization of mangrove forest. The research method used is quantitative method by using benefit cost analysis. In brief, the results showed that the utilization of mangrove resources conducted by the community or local community groups such as mangrove crab cultivation, mangrove seedling, mangrove dodol, mangrove syrup and mangrove tourism. The highest direct benefits of mangrove area came from mangrove seedlings (71%), mangrove dodol (9.76%), mangrove tourism (6.82%), mangrove crab (6.47%) and mangrove syrup (5.96 %). Meanwhile the value of choice for mangrove area is 30 Ha. From the calculation results, the benefit obtained of mangrove forest selection was Rp 6.087.150,00 per year. Based on the mentioned value, it indicated that the respondents were willing to pay for the existence of mangrove forest ranging from Rp 50.000,00 – Rp 750.000,00. The total existence value of mangrove forest was Rp 4.375.000,00 for 50 respondents and the total value of existence per year was Rp 52,500,000.00. The total benefit of mangrove forest was Rp 4,749,322,671,00 per year. As the result, the 87% indirect benefit is the largest contributor to the benefits of mangrove forests in South Bontang District. While the second largest contributor is a direct benefit of 12%.

INTRODUCTION

Mangrove forest is an important natural resource in a coastal environment that have three main functions: physical, biological, and economic functions. Firstly, the physical mangrove function is as a windbreak, filter contaminants, waves, flood control and prevention of intrusion of seawater to the mainland. Secondly, the biological functions are spawning ground, nursery ground, and feeding ground for fish and another marine biota. Thirdly, the economic functions that are obtained are as a producer of wood for raw materials and building materials, foodstuffs and medicines. In addition, other functions implemented by the Badak LNG CSR program to the coastal community of Bontang City is mangrove forest as a media of mangrove crab cultivation and mangrove seedling.

Mangrove resources can be utilized sustainably for the economic improvement of communities around the mangrove forest. The potential of natural resources of coastal and ocean areas in Indonesia extremely needs a good management, so that the utilization can take place continuously in accordance with the concept of sustainable development which becomes the basis of the concept of national development.

Besides having ecological functions, the mangrove forest area also holds great economic potential (Budi Setiawan, 2017). Many studies have successfully mapped the economic potential of the mangrove area from the potential of fisheries, mangrove agriculture and the utilization of mangrove, ecotourism, etc. Along with the diversity of ecological and economic functions, the harmony between the two can be utilized to improve the welfare of the community directly in contact with the mangrove forest.

Moreover, the mangrove area holds great economic potential if it is managed well and not excessively. It goes without saying that the great potential requires professional and sustainable management.

During this time, the mangrove area tends to be damaged due to land degradation which

causes changes in coastal environment. Further, mangrove forest degradation affects in coastal ecosystem changes, such as seawater intrusion, coastal abrasion, extinction of certain species of flora, fauna and biota, declining biodiversity and habitat destruction that extends to land (Saparinto, 2007).

Bontang City is one of the coastal areas on the island of Borneo. Administratively, Bontang City is divided into 3 District, North Bontang, South Bontang and West Bontang. Overall, the area of Bontang City reaches 497.57 km², in which most of the area is waters, while the land area is only about 29%. The largest land area is in South Bontang Districts, about 70.6% of the land area of Bontang City (Bontang City BPS 2017).

Further, Bontang city has a large area of mangrove forest. There have been many efforts to exploit mangrove forests which have been done by the community, such as, taking wood, fisheries, and so on. This mangrove area mostly grows naturally. However, nowadays there are many developed artificial mangrove forest areas. The aim is to improve ecological functions and encourage local economic potential.

In its development, there are some big companies which are located in the city such as Badak LNG that gives CSR program namely mangrove forest exploiting program as the media of mangrove crab cultivation and mangrove seedling. Badak LNG has a social and company interest in the effort of mangrove area development. Its social interests are to improve the welfare of the people of Bontang City and increase the carrying capacity of the environment primarily mangrove areas. Meanwhile, its company interest is to maintain a green area or buffer zone around the company by providing examples of mangrove area empowerment in the surrounding location.

Then, the company provides training, assistance and help for cultivation of crabs and mangrove seedling as the implementation of the program. Whether the distribution of the location of the implementation can be seen in the following picture.



Figure 1. The Location of the Implementation of Mangrove Crab Cultivation and Mangrove Seedling Development Location.

Apparently, the existence of the program has a positive effect on the economic improvement of the local community. Therefore, this study attempts to calculate how much economic valuation resulted from the utilization of mangrove forest.

RESEARCH METHOD

In this study, the location studied was Bontang City of East Borneo Province. The sample of the area studied was the mangrove area in South Bontang District. The method of data retrieval was done by interviewing key person such as the leader of mangrove farmer group in Bontang city, people who moved directly on the activities in the mangrove forest, and also the Badak LNG as the giver of CSR. While the respondent was people who used mangrove resource for mangrove crab cultivation and mangrove seedling.

The study was conducted through three stages, the first was identification of the utilization of mangrove resources. It was conducted through depth interview to analyze 3 components according to Kovacs (1999) in Maedar (2008) namely the identification of mangrove species that can be used, type of utilization, implementation of utilization which had been done.

The second stage is the identification of the benefits and functions of mangrove ecosystems by using direct benefit analysis (DB). Direct benefit itself is the value which is resulted from direct use of mangrove forests such as fisheries, firewood and tourism (Fauzi, 2002).

$$DB = DB1 + DB2 + DB3 \dots + DBn$$

Note:

DB1 = Direct benefit, total from fishery product, DB2 = Direct benefit, total of pond result, DB3 = Direct benefit, total of mangrove seed yield, DB4 = Direct benefit, total from mangrove fruit.

Then, an indirect benefit analysis (IB) is a perceived value indirectly to the goods and services produced by the resources and the environment (Fauzi, 2002). The indirect benefits of mangrove forests are derived from an indirect ecosystem such as coastal abrasion retention and provision of organic materials for living biota (Gittinger, 2008).

$$IB = IBe + IBb$$

Notes:

IBe = Indirect ecological benefit as a coastal abrasion retarder, IBb = Indirect biological benefit as a place of fish enlargement.

The estimation of indirect benefit of mangrove forests as coastal abrasion retarders were approached by making green belts which

were equivalent to mangrove forest functions as a coastal abrasion retarder. The method which was used to measure the value was replacement cost.

In addition, option benefit analysis was also done. This analysis showed willingness to pay in an effort to preserve and maintain the mangrove ecosystem in the long term. The approach referred to the biodiversity value of mangrove forests in Indonesia. The reference was the biodiversity value of mangrove forest in Indonesia that is US \$ 1,500 / km²/year or US \$ 15/ha/year (Ruitenbeek, 1998 in Supriyadi 2009). According to Benu, et al. (2010) and Linda and Fitria (2013), this concept can be used in all mangrove forests in Indonesia if the ecological forest ecosystems are ecologically important and naturally maintained. If it is formulated it will be as follows: $CB = OBb$ (Option Benefit biodiversity) = US \$ 15 per ha x Area of mangrove forest.

The next benefit analysis is the existence benefit. This benefit has been felt by the community from the existence of the ecosystem which was studied after other benefits (direct benefits, indirect benefits and option benefits). The measurement of the benefits of existence through direct measurement of individual preferences through Contingent Valuation Method (CVM).

Then, to analyze a project from an economic point of view is by using the Cost Benefit Analysis (CBA) method. This stage was done after all economic analysis was done. There were several assumptions in this analysis: (1) the constant fish production due to conservation efforts; (2) the aquaculture system still exists since there were efforts to maintain the condition of mangrove resources; (3) the seedling remained due to efforts to maintain the sustainability of mangrove resources; (4) the production of mangrove fruit remained due to efforts to preserve mangrove forests; (5) the type of utilization of mangrove resources remained and was converted to unit area; (6) the cost benefit analysis was conducted on the initial condition of mangrove forest and under present condition; (7) the loss of direct benefits, indirect benefits, option

benefits and existence benefits due to conversion of mangrove forests into loss costs in mangrove forest management; (8) the duration of the analysis was 10 years, ecologically the time period was used on the basis that mangrove age has reached the establishment of an ecological system.

RESULTS AND DISCUSSION

The mangrove area of South Bontang District has existed since many years ago. In its journey, mangrove forests become the habitat for various animals and plants. Local people also take advantage of mangrove forests for fishing, shrimp, crab and other marine products. The surrounding community also begins to use mangrove plants to meet their needs.

The extent of mangrove area in South Bontang District reaches 40 hectares. The utilization is also quite diverse, either to meet the needs only and also commercial scale. In Table 1, it can be seen that several types of utilization of mangrove resources that exist in the research location and can directly be perceived benefits by the communities around the location of the mangrove forest. The dominant species of mangrove vegetation are in the research sites and the ones which are often utilized by surrounding communities are the mangrove species (*Rhizophora mucronata*) and the fires (*Avicenniamarina*).

Table 1. The Utilization of Mangrove Resources in South Bontang District

No.	Benefit	Average Utilization per Year
1	Crab (kg)	1,200 *
2	Mangrove Seeds (stems)	250,000
3	Tourism (person)	65,000*
4	Mangrove Syrup (bottle)	3,000
5	Mangrove Dodol (pack)	4,500

Source : Primary Data Processed

As mentioned before, the utilization of mangrove forest by the community is now quite

diverse. Some of the utilization include the utilization of crab cultivation, processing of mangrove seeds, mangrove forest tourism, and mangrove syrup and dodol. Moreover, the community also runs a partnership pattern in the utilization of mangroves. During this time, people will often have difficulty if they have to move themselves. Consequently, the partnership pattern built is empowerment. The Badak LNG has partnered with a diverse group of fishermen and communities. On one hand, the community-

based management is important to maintain the sustainability of mangrove forests themselves. On the other hand, it will improve the standard of living for the better future.

Meanwhile, the method used to assess the direct benefits is the market value approach. This approach was done by multiplying the types of products that can be utilized directly by the community economically with market value. Hence, the value of economic benefits will be directly known.

Table 2. The Direct Benefit Value of Mangrove Resources in South Bontang District

No	Kind of Benefit	Producti on Volume per Year	Market Value (Rp/ unit)	Benefit Value (Rp/ Year)	Cost Investation (Rp/year)	Operational (Rp/year)	Total Cost (Rp/year)	Net Benefit (Rp/year)	Percent age (%)
1	Crab (kg)	1,200	70,000	84,000,000	44,550,000	3,600,000	48,150,000	35,850,000	6,47
2	Mangrove Seed (Stem)	250,000	3,500	875,000,000	65,020,000	416,666,667	481,686,667	393,313,333	71,00
3	Tourism (person)	65,000	3,000	195,000,000	147,226,000	10,000,000	157,226,000	37,774,000	6,82
4	Mangrove Syrup (bottle)	3,000	20,000	60,000,000	10,000,000	17,000,000	27,000,000	33,000,000	5,96
5	Mangrove Dodol (pack)	4,500	15,000	67,500,000	12,000,000	1,440,000	13,440,000	54,060,000	9,76
Total				1,281,500,000	278,796,000	448,706,667	727,502,667	553,997,333	100

Source: primary data processed, 2017

Based on Table 2, the largest direct benefit derives from mangrove seedlings (71%), followed by mangrove dodol (9.76%), mangrove tourism (6.82%), mangrove crab (6.47%) and mangrove syrup (5.96%). The mangrove seedling still becomes the main income of the respondents since the promised value from selling mangrove seeds is quite big and able to sustain the household needs. In addition, based on the results of the study, a respondent is able to get an average income of 5 million rupiah per month from the results of mangrove seedling.

Besides, mangrove seedlings have become the prima donna of people's income since the demand for mangrove becomes very high. As well as the Badak LNG which is one of the

companies which buys mangrove seeds from farmers to do CSR in the field of environment by planting mangroves as a form of corporate action to tackle abrasion in the coastal area of South Bontang District. Mangrove seedling has a net benefit value of 393,313,333 Million Rupiah which is extremely big. The marketing collateral pattern conducted by CSR Badak LNG is considered very helpful for mangrove farmers to sell their products. Indeed, this pattern brings immediate benefits since one of the main obstacles of utilization of mangrove results is its marketing.

Then, the net benefit value of crab cultivation per year is Rp 35,850,000. In the percentage value, it is obviously far below the

value of the benefits from the cultivation of mangrove seeds. However, as a part of the diversification of utilization, the net benefit value of crab cultivation is considered good enough because it still provides benefits. Additionally, the problem that arises from the cultivation of crabs is lack of crops since the seeds are still limited. During this time, crab farmers still rely on seed from CSR Badak LNG. However, the prospect of crab cultivation is quite good. The demand for mangrove crab from Bontang is always high as well as the selling price. The only constraint is the lack of production due to the limited seeds stocked.

The measurement of indirect benefits is the physical and biological benefits. The physical benefits include the ability to withstand the abrasion which is calculated by the replacement cost of the development of the green belt. In coastal areas that have been built green belt, have been able to capture sediment and protect ponds or other buildings behind it, empirically, the mangrove area will strengthen the existence of the green belt.

Further, the cost of replacing the development of the green belt of South Bontang District is based on the estimation made by Environmental Agency of Bontang City (2016) that is Rp 3,910,709,500. While the value of biological benefit as a place of fish enlargement (nursery ground) is calculated through a productivity approach. According to Adrianto (2004), mangrove ecosystem has a function as a place of fish enlargement (nursery ground), so that the ecosystem area becomes input for fish catch productivity that will become economic commodity of fishermen.

According to the Office of Marine and Fisheries Bontang City (2017), the total value of fish catches around the mangrove area ranges around Rp 226.028.688,00. While the total value of indirect benefits of mangrove resources in which the sum of physical plus the biological value is Rp 4.136.738.188, 00.

Then the next is the value of the option benefit. This value is calculated from the value of biodiversity. Referring to the value of mangrove forest biodiversity in Bintuni Bay, Irian Jaya's is US \$ 15/ha/year which was conducted by Ruitenbeek (1998), is appropriate research as a reference for environmental-economic assessment applied to policies in various resources use in coastal areas (Supriyadi, 2009). The value of the benefits of mangrove ecosystem choices in South Bontang District is assumed to be equal to the value of biodiversity in Bintuni Bay Irian Jaya. The same assumption has been done by Maedar (2008) in Merawang District of Bangka Regency with mangrove forest area 12,50 ha and Hiariey (2009) in Tawiri Ambon Village with mangrove forest area which is only 3.08 ha.

The value of the option benefit is obtained from the multiplication of biodiversity value with Rupiah exchange rate against US Dollar by using the middle rate of Bank Indonesia of Rp 13,527.00 (dated December 4, 2017). Though the area of mangrove land in South Bontang District is 30 Ha. The calculation results option benefit of mangrove forest in South Bontang Sub-District is Rp 6,087,150,00 per year.

Then, other benefits of mangrove are the benefits of existence. The value of the existence benefit for mangrove forest in South Bontang Subdistrict uses Willingness To Pay (WTP) value approach. The approach aims to know the willingness of the community to pay for the existence of mangrove forest. While the method used to measure the existence of mangrove values is by using Contingent Valuation Method (CVM). Respondents were selected based on the Accidental Sampling method in which the researcher did not specify and they were randomly asked.

The results shows that respondents are willing to pay for the existence of mangrove forest ranging from Rp 50,000.00 – Rp 750,000.00. The total existence value of mangrove forest is Rp 4,375,000.00 for 50 respondents and per year is Rp 52,500,000.00.

Table 3. Recapitulation of Benefit Value of Mangrove Forest in South Bontang District

No	Benefit Type	The Value of Benefit (Rp/year)	Percentage (%)
1	Direct Benefit	553,997,333	12
2	Indirect Benefit	4,136,738,188	87
3	Option Benefit	6,087,150	0
4	Existence benefit	52,500,000	1
Total		4,749,322,671	100

Source: primary data, processed

After the four values have been calculated, the total value of the benefits of mangrove forest in South Bontang District is obtained. The calculation of total benefits of mangrove is by adding up the value of direct benefit, indirect benefit, option benefit and existence benefit. Based on table 3, the total benefit of mangrove forest in South Bontang District is Rp 4,749,322,671.00 per year. Above all, the indirect benefit (87%) are the largest contributor to mangrove forests in South Bontang District. The second largest contributor to mangrove benefit in South Bontang District is direct benefit (12%).

CONCLUSION

Based on the result of this research, it can be concluded that direct benefit value of mangrove area in South Bontang sub-district is mostly from mangrove seedlings (71%), followed by mangrove dodol (9.76%), mangrove tourism (6.82%), mangrove crab (6.47%) and mangrove syrup (5.96%). The value of option benefit for mangrove area in South Bontang District is 30 Ha. The calculation result shows that the benefit result of mangrove forest selection in South Bontang District is Rp 6.087.150,00 per year.

In addition, based on the value of the existence benefit indicates that the respondents are willing to pay for the existence of mangrove forest ranging from Rp 50.000,00-Rp 750.000,00. The total existence value of mangrove forest is Rp 4.375.000,00 for 50 respondents and the total value of existence per year is Rp 52,500,000.00. The total benefit of mangrove forest in South Bontang District is Rp 4,749,322,671,00 per year. Shortly, the indirect benefit (87%) is the largest

contributor to mangrove forests in South Bontang District. While the second largest contributor to mangrove benefits in South Bontang District is direct benefits (12%).

REFERENCES

- Badak LNG. 2016. Laporan Program Community Development 2016. Bontang: Badak LNG.
- Badak LNG. Laporan Evaluasi Program CSR Badak LNG 2015-2016. Bontang: Badak LNG.
- Balai Lingkungan Hidup Kota Bontang. 2017. Monografi Pesisir Kota Bontang. Bontang.
- BPS Kota Bontang. 2017. Bontang Dalam Angka 2017. BPS.
- BPS Kota Bontang. 2017. Statistik Saku Kota Bontang 2017. BPS.
- BPS Kota Bontang. 2017. Kecamatan Bontang Selatan dalam Angka 2017. BPS.
- Benu, Suzana L. Olfie, J. Timban, Rine. K, dan A. Fandi. 2011. Valuasi Ekonomi Sumberdaya Huta Mangrove Di Desa Palaes Kecamatan Likupang Barat Kabupaten Minahasa Utara. *Jurnal ASE*. 7 (2): 29 – 38
- Budi Setiawan, A., & Adzim, F. (2017). Determinant of Poverty in Indonesia. *Economics Development Analysis Journal*, 6(1), 22-29.
- Dinas Kelautan dan Perikanan Kota Bontang. 2015. Laporan Akhir Penyusunan Review Database dan Kajian Potensi Laut, Pesisir dan Pulau-Pulau Kecil Kota Bontang. Bontang.
- Dinas Kelautan dan Perikanan Kota Bontang. 2016. Rencana Strategis Tahun 2011-2016. Bontang.
- Dinas Kelautan dan Perikanan Kota Bontang. 2017. Laporan Akhir Penyusunan Rencana Tata Ruang Pesisir Kota Bontang. Bontang.
- Fauzi, A. 2002. Valuasi Ekonomi Sumberdaya Pesisir dan Lautan. Makalah pada Pelatihan Pengelolaan Sumberdaya Wilayah Pesisir dan Lautan. Universitas Diponegoro. Semarang.

- Gittinger, J.P. 2008. Analisis ekonomi Proyek-Proyek Pertanian. UI-Press. Jakarta
- Hiariey, L. S. 2009. Identifikasi Nilai Ekonomi Ekosistem Hutan Mangrove di Desa Tawiri Ambon. *Jurnal Organisasi dan Manajemen*. 5(1): 23 – 34.
- Kalitouw, Winda Desitha. 2015. Valuasi ekonomi Hutan Mangrove di Desa Tiwoho Kecamatan Wori Kabupaten Minahasa Utara. Skripsi.
- Linda, W. Z. dan Fitria Ulfah. 2013. Valuasi Ekonomi Hutan Mangrove Di Pulau Dompok Kota Tanjungpinang Propinsi Kepulauan Riau. *Jurnal Dinamika Maritim IV* (1): 45 – 52.
- Hermansyah, Hermansyah; Sunaryo, Busori. 2016. Supervising Model of Independent Enterprise Group (Study of Community Development PT Badak NGL). *JEJAK: Jurnal Ekonomi dan Kebijakan*, [S.l.], v. 9, n. 1, p. 1-15, Jun. 2016. ISSN 2460-5123. Available at: <<https://journal.unnes.ac.id/nju/index.php/jejak/article/view/7183/5230>>. Date accessed: 22 Feb. 2017. doi:<http://dx.doi.org/10.15294/jejak.v9i1.7183>.
- Maedar, F. 2008. Analisis Ekonomi Pengelolaan Mangrove di Kecamatan Merawang Kabupaten Bangka. Sekolah Pascasarjana Institut Pertanian Bogor. Bogor.
- Ruitenbeek, H. I. 1998. Mangrove Management: An Economic Analysis of Management Option with a Focus an Bintury Bay Irian Jaya. *Environment Management in Indonesia Project (EMDI)*. Jakarta.
- Saparinto, C. 2007. Pendayagunaan Ekosistem Mangrove Mengatasi Kerusakan Wilayah Pantai (Abrasi) Meminimalisasi Dampak Gelombang Tsunami. Effhar dan Dahara Prize. Semarang.
- Setiyowati, Desti, Supriharyono dan Imam Triarso. Valuasi Ekonomi Sumberdaya Mangrove di Kelurahan Mangunharjo, Kecamatan Tugu, Kota Semarang. at *Indonesian Journal of Fisheries Science and Technology (IJFST)* Website: <http://ejournal.undip.ac.id/index.php/saintek> Saintek Perikanan Vol.12 No.1: 67-74, August 2016 Accessed on 14th of December 2017.
- Suparmoko. 2006. Panduan dan Analisis Valuasi Ekonomi Sumberdaya Alam dan Lingkungan. Yogyakarta.
- Supriyadi, H. I, 2009. Pentingnya Valuasi Ekonomi Sumberdaya Alam Untuk Pengambil Kebijakan. *Oseana*. XXXIV (3): 45 – 57