Handline Fishing Efficiency in Kayubulan Village, Gorontalo Regency

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Abstract

This study aims to determine the technical efficiency, allocative efficiency, and the economic efficiency of handline fishing gear in Kayubulan Village, Batudaa Pantai District, Gorontalo Regency, Gorontalo Province. This research was conducted in October-November 2018. This study uses a quantitative descriptive method using DEA (Data Envelopment Analysis) to measure technical efficiency and CBA (Cost Benefit Analysis) to measure allocative efficiency (price) and economic efficiency analysis is the result of technical efficiency and allocative efficiency (price). Analyzing technical efficiency using DEAP software version 2.1. The results of the study indicate that the technical efficiency (ET) that the average value of the technical efficiency value obtained is 0.788 or <1, meaning that the fishing effort of handline fishermen is not technically efficient. The average allocative efficiency/price (EH) obtained is 3,881 or >1, so fishing business using handline fishing gear is allocatively efficient. The average economic efficiency obtained is 3,091 or >1, so the average fishing effort using handline fishing gear is economically efficient.

Keywords: Efficiency; technical; allocative, economic; handline, DEA

Introduction

The potential of marine resources in Indonesia has been utilized in various economic activities, one of which is in the capture fishery business. Capture fisheries itself is a unique economic activity when compared to other activities. This is related to the condition of marine resources and fish themselves which are often considered as common property resources (Desniarti et al, 2006).

Marine resources in Indonesia, especially in Sulawesi, are quite abundant, rich and diverse, especially in coastal areas. With the increasing rate of population growth, the demand for marine products, especially fish, is increasing. The increasing demand requires fishermen and entrepreneurs engaged in fishing to increase their production (Suhartono, 2004).

Increasing the catch of fishermen depends on the use of production inputs. Information regarding the effect of production inputs is needed so that fishing efforts run optimally with the use of effective and efficient production inputs so as to increase catches and fishermen's income (Alhuda et al, 2016). This means that to produce the highest efficiency value, fishermen must be able to take into account the combination of production factors with the catch obtained. The difference in the number of production inputs causes different efficiency values (Azizah, 2016).

According to Hasibuan (1984) in Wicaksono et al (2014), efficiency is the best comparison between inputs and results between profits and the sources used, as well as optimal results achieved with the use of limited resources. Efforts to increase efficiency are generally associated with lower costs to obtain a certain result or with a certain cost to obtain a lot of results. This means that waste is kept to a minimum and anything that is possible to reduce these costs is done for efficiency.

Kayubulan Village is one of the villages located in Batudaa Pantai District, Gorontalo Regency, Gorontalo Province (Kayubulan Village Profile, 2017). The majority of the residents of Kayubulan Village make a living as fishermen. Some fishermen in this village carry out fishing business using handline fishing. In general, fishermen have not been able to use a combination of inputs that match the catch they get. The allocation of a combination of production inputs can increase efficiency which in turn can increase fishermen's income.

This study aims to determine the efficiency of handline fishing gear in Kayubulan Village. The results of this study are expected to serve as input for the government and other parties in an effort to find approaches to improve technical, allocative and economic efficiency of handline fishing gear and can be used as basic information for further researchers regarding technical, allocative and economic efficiency of handline fishing gear.

Research Methods

The research was carried out in Kayubulan Village in October-November 2018. The data collected consists of primary data and secondary data. Primary data obtained from observations and interviews with respondents directly in the field. Data collected on the volume of catch (Kg/Trip), supplies cost (Rp/Trip), fuel (Liter/Trip), number and length of trips, engine size (PK), boat size (GT) and number of crew (fishermen). Secondary data is data used to support information obtained from village profiles, previous research, and literature related to this research.

The sampling technique is carried out using the proposive sampling method, namely taking samples based on considerations or the researcher considers what is taken to have information and is related to the research objectives (Hiola, 2017). The sample to be taken is determined by 65 people from 185 fishermen (Profile of Kayubulan Village, 2017). This sampling was determined using the slovin formula (Simanjuntak, 2016).

The analytical method used in this research is descriptive quantitative method. This research method is used to collect data or information about a population by using a sample. The characteristic of this research method is that information is obtained from the sample and collected through asking questions (oral or written) (Aprilia, 2011).

Data Envelopment Analysis (DEA) is an analysis for measuring efficiency that is value free because it is based on available data without having to consider the judgment of the decision maker. DEA model approach, which is a mathematical programming approach to estimate technical efficiency (TE) and capacity output. DEA analysis aims to measure the relative performance of the unit of analysis in the condition of the existence of multiple inputs and outputs (Wardono, 2016).

The technique, also known as CCR (from the first names of the three inventors: Charnes, Cooper and Rhodes, 1978), is a measurement of the relative efficiency performance of DMU decision making units (decision making units) in an activity. In fisheries applications, DEA has the advantage of being able to estimate capacity under the constraints of implementing certain policies (Nababan and Sari, 2010). Another feature of the DEA model is its ability to accommodate multiple outputs and multiple inputs (Wardono, 2016). Data Envelopment Analysis (DEA) in this study was carried out with the help of DEAP version 2.1.

B/C is the value or benefit obtained from each unit of cost incurred. Where B/C is obtained by dividing the total revenue by the total expenditure. Kadariah and Gray (1987) in Alhuda et al (2016), stated that to determine the level of efficiency of a business, a parameter can be used, namely by measuring the amount of income divided by the amount of expenditure.

Economic efficiency is a product of technical efficiency and price efficiency. (Susantun, 2000 in Sutanto, 2005). So economic efficiency can be achieved if both of these efficiencies are achieved.

Results and Discussion

Technical efficiency

Technical efficiency is a measure of the best production capability and optimal output that may be achieved from the various inputs and technologies used (Viswananthan et al, 2003 in Sutanto, 2005). In this study, technical efficiency was measured using the computer program Data Envelopment Analysis (DEA) Version 2.1. The average results of the technical efficiency analysis of fishing business with handline fishing gear in detail can be seen in Table 1.

Table 1. Results of DEA analysis on average technical efficiency of handline fishing gear in Kayubulan Village

No	Variables	ET
1	Input_1 (provision cost)	2.557
2	Input_2 (fuel)	0.427
3	Input_3 (number of trip)	1.115
4	Input_4 (length of trip)	0.126
5	Input_5 (boat dimension)	0.051
6	Input_6 (engine capacity)	2.622
7	Input_7 (number of crew)	0.064

The variable cost of supplies (input_1), the variable number of trips (input_3) and the variable size of the machine are technically efficient, namely the efficiency score is above 1. This can be interpreted that the more supplies that are brought at sea, the more optimal the performance of fishermen will be so that they will get bigger catches. According to Aprilla et al (2013), the acquisition of catches can be further increased by increasing the cost of supplies. In other words, there is always an opportunity to rearrange the combination and use of factors of production from the cost of supplies in such a way as to obtain a larger catch. With adequate supplies, it can encourage the performance of the crew to be more optimal, based on the results of interviews with fishermen stating that the more guaranteed all the necessary needs are, the more optimal their performance will be.

The number of fishing operations and the size of the machine is also one of the factors that affect the catch of fishermen. The greater the number of fishing operations or the number of trips, the greater the catch will be and by adjusting the combination of engine sizes according to the size of the ship used so that there is a balance and there will be no technical inefficiency. Based on the research of Iskandar and Guntur (2014), the number of fishing operations and a wider range of fishing areas will provide opportunities for fishermen to obtain more catches. The larger the size of the machine will be able to reach the desired fishing ground area further and faster so that fishermen will get bigger catches.

The variables of fuel (input_2), length of trip (input_4), boat size (input_5) and the number of crew members or fishermen (input_7) have not yet achieved technical efficiency (TE) or inefficiency scores. This shows that there has been a less than optimal use of production factors by handline fishermen in Kayubulan Village in their fishing operations. In general, handline fishermen in Kayubulan Village use limited fuel according to the desired fishing area because almost the average fisherman uses the reach of his catch area quite far from the mainland, this is what causes the BBM variable to not achieve an efficiency score. According to Sutanto (2005), fuel is a very important production factor because without fuel the boat cannot be run and determines how far the boat can reach the fishing ground. The more fuel that is brought, the more flexible fishermen will be in reaching the desired fishing ground where there are lots of fish.

The variable length of trip has a negative effect or has not reached the efficiency score. This can be interpreted that the number of catches is not determined by the length of time at sea. In general, handline fishermen in Kayubulan Village if they get enough results or the average fishing time is 2-6 hours/trip then they will return to the mainland because they bring enough fuel for the time of the fishing operation by bringing their catch. The boat size variable (input_5) used by handline fishermen has not yet achieved an efficiency score, this is because handline fishermen in Kayubulan Village generally operate on a small scale and the boat size is also small. The size of handline fishing boats in Kayubulan Village ranges from 2-3 GT. According to Effendi (2018), there is no guarantee that the bigger the boat, the higher the ability to get more catches. It is theoretically shown that the large size of the ship will have implications for the range of fishing areas that are getting farther away. In addition, the factor of increasingly limited fish resources causes the larger ship size does not necessarily have high efficiency.

The variable number of crew members (fishermen) is one of the variables that has not achieved an efficiency score, this is because handline fishermen in Kayubulan Village almost only use small number of labor. This means that a larger number of fishermen will not affect the catch obtained during fishing operations. According to Aprilla et al (2013), the addition of the use of these production factors can result in a decrease in total production, to achieve efficiency from the use of these production factors, it is necessary to reduce the use of the ship's engine power production factor, the number of crew members, and the number of lights so that it can be efficient in get the catch. Reducing the use of ship engine power used can be adjusted to the size of the ship. In addition, fishermen's income is very dependent on the operational costs of catching in one fishing trip and the catch obtained.

Based on his research, Sulistyowati (2017), fishing time and fishing experience ratio is 0, which means that fishermen are not limited by time when they get their catch, they continue to return to the fishing port so that fuel is more effective. The experience of going to sea for fishermen is not needed too long because the longer it means the fishermen are old so that the energy is reduced. Therefore, it is necessary to use appropriate inputs in order to obtain optimal catches.

The number of handline fishing boats analyzed in Kayubulan Village reached 65 boats. Of these, 12 boats (18%) were efficient with an efficiency score equal to 1, and 53 boats (82%) of them were not efficient with an efficiency score of less than 1, namely 5 boats (8%) had an efficiency score between 0.91-0 .99, 12 boats (18%) had an efficiency score of 0.81-0.90, 16 boats (25%) had an efficiency score between 0.71-0.80, 12 boats (18%) had an efficiency score between 0, 61-0.70, 7 boats (11%) had an efficiency score between 0.51-0.60, and the remaining 1 boat (2%) had an efficiency score between 0.41-0.50.

According to Olii et al (2007), ships with an efficiency value below 70% need a lot of improvement to achieve efficiency, while ships with an efficiency value below 10% should no longer be used for fishing activities. The technical efficiency of handline fishing gear, mostly only reached 12 boats out of 65 boats. Thus, the actual use of handline fishing gear is not yet close to efficient in using its inputs. While the inefficiency reached 53 boats with an average efficiency score of 0.788. Therefore, to increase fishermen's income from fishing efforts, fishermen should use inputs more efficiently.

Regarding the technical aspects of the continuity of fishing operations, fuel is an important factor for the

mobilization of fishermen in exploring fishing areas. An adequate amount of fuel allows fishermen to reach better fishing locations (Aprianto 2008 in Guntur, 2013).

Based on research by Azizah (2016), technical efficiency is calculated based on the fishing season, due to differences in the number of production factors. Based on the results of the research, the total value of technical efficiency from the peak season, transition season, and lean season which has the highest efficiency value is category 4, namely setnet nets carrying 7 pieces of fishing gear.

Based on research by Olii et al (2007), the most efficient fishing gear for the southern coastal waters of Gorontalo is ring trawl and fishing line, while gill nets are an inefficient type of fishing gear so that their use needs to be considered in the future. This shows that in addition to ring seines and fishing rods, bag trawls, gill nets and lift nets cause "overcapacity".

Allocative efficiency

The average monthly income and total cost of handline fishermen in Kayubulan Village can be seen in Table 2.

Table 2. Monthly total income and cost for handline

Remarks	Minimum	Maximamu	Average
Income	1,500,000	11,500,000	6,306,154
Total cost	1,030,833	4,506,251	1,776,446
Fixed cost	130,833	2,239,583	389,053
Variable cost	832,500	2,358,000	1,387,393
B/C			3,881

The average total monthly income of the 65 handline fishermen analyzed is Rp. 6,306,154 while the average total cost of handline fishermen per month is Rp. 1,776,446. The result is that the average fixed cost of handline fishermen per month is Rp. 389.053 and the average variable cost of handline fishermen per month is Rp. 1,387,393. Comparison between total revenue and total costs obtained a B/C ratio of 3,881. This proves that the fishing effort using handline fishing gear carried out during the peak season in Kayubulan Village is allocatively efficient.

According to Digal et al (2017), the factors that can affect the efficiency level of fishermen's handline fishing gear using the Tobit model, it was found that fishing operations, length of trip, number of crew members, cost of supplies, radio costs, fuel and number of trips significantly affect the efficiency of fishing gear.

According to Sukiyono and Romdhon (2016), increasing efficiency should be more emphasized on increasing the number of catches and maintaining the stability of the price of fish caught. In other words, efforts to increase allocative efficiency do not always have to be done by increasing the number of inputs used, but can also be done through the components that make up the efficiency itself. Especially in the capture fisheries business, efforts to increase allocative efficiency are through increasing the number of catches while maintaining the sustainability of marine fisheries.

According to Wardono (2013), changes in efficiency and changes in efficiency scales are tools to direct fishermen's efficiency improvement programs that can direct policy makers in determining priorities regarding fishing technology and fishermen's skills. Changes in total factor productivity describe changes in the level of technology compared to changes in the level of efficiency.

Efficiency in a production process has an important meaning in increasing income. If production efficiency is implemented properly, it will encourage the optimal use of production factors, which in turn will provide maximum profit for business actors. (Sutarni, 2013 in Mariani et al, 2013).

Economic efficiency

Economic efficiency is a product of engineering efficiency and allocative efficiency. The average economic efficiency (EE) of fishing business using handline fishing gear is 3,091. Because the economic efficiency is greater than 1, it can be concluded that the use of handline fishing gear in Kayubulan Village is efficient, so that the average handline fisherman can be said to be economically efficient with the use of a certain number of inputs. Thus, it is hoped that the efficient use of these inputs will result in optimal fish catches.

The level of economic efficiency of the 65 respondents analyzed varies, between 0.91-0.99 which is not yet efficient or inefficiency. The use of production factors for handline fishing gear units in Kayubulan Village is in an already economically efficient condition, where the value is at most greater than one with an average efficiency score of 3,091. Overall, it can be said that most of the handline fishermen are efficient.

According to Aprilla et al (2013), this condition requires fishermen to be more careful in the use of fishery business production factors that affect the catch obtained so as to achieve economic efficiency. Other things that affect the level of economic efficiency here, apart from the availability of fish resources are minimal in the west season, also because fishermen cannot reach fishing areas further away, fishermen only carry out fishing

operations close to the coast and the cost of fishing production factors has increased prices so that it suppresses fishing operational costs.

Achievement of overall efficiency can occur if the quality of fishermen can be improved related to mastery of technology that is able to provide clear guidelines regarding the existence of groups of fish in the waters. The ability to manage fishing operational costs is also very influential so as to be able to allocate existing fish resources effectively and efficiently which ultimately results in maximum production (Aprilla et al, 2013).

Conclusion

Technically the handline fishing gear used by fishermen in Kayubulan Village is not efficient but economically efficient. The allocative/price of handline fishing gear used by fishermen in Kayubulan Village is efficient.

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