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Perception Towards the Performance of Outboard Motors Among Malaysian Coastal Fishermen in Manjung, Perak

(Persepsi Terhadap Prestasi Motor Enjin Sangkut di Kalangan Para Nelayan Pantai Malaysia di Manjung, Perak)

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ABSTRACT

Fishermen, particularly those in coastal seas, are often categorized under low-income community. Many efforts have been taken to assist this community to sustain their livelihoods, but hampered by various factors such as high operational cost. Coastal fishing boats specifically made from fiberglass are greatly dependent on petrol-powered outboard motor to generate power. The high fuel consumption of outboard motors is believed one of the factors that contribute to their high operational cost. To this end, it is necessary to dive into the fishermen's perception on this issue. This paper presents finding on the perception of coastal fishermen towards the performance of outboard motors and their views on fuel-saving engines. Some key areas are discussed and explained in this paper. A questionnaire had been developed as a survey tool; divided into three parts, covering cost factor, engine factor and operation factor. The questionnaire was developed based on Likert scale and distributed to randomly selected respondents among the fishermen community at Manjung, Perak. The data was then processed using Statistical Package for Social Science (SPSS). The results showed that inshore fishermen are not satisfied with petrol outboard motor, with more than 95% confidence level.

Keywords: Coastal Fisheries; Outboard Motors; Fuel Consumption

ABSTRAK

Komuniti dalam sektor perikanan, terutamanya nelayan persisiran pantai, kerapkali dianggap sebagai komuniti yang berpendapatan rendah. Pelbagai usaha telah dilakukan untuk membimbing komuniti ini untuk menampung kehidupan mereka, namun tetap dibelenggu faktor-faktor seperti kos operasi perikanan yang tinggi. Bot-bot perikanan persisiran pantai yang diperbuat daripada gentian kaca amat bergantung kepada motor enjin sangkut petrol untuk janaan kuasa. Kos bahan api yang tinggi untuk motor enjin sangkut dipercayai merupakan salah satu faktor yang menyumbang kepada kos operasi yang tinggi tersebut. Atas hal ini, adalah perlu untuk mengetahui persepsi para nelayan terhadap isu tersebut. Kertas kajian ini membentangkan dapatan tentang persepsi para nelayan persisiran pantai terhadap prestasi motor enjin sangkut, dan juga pandangan mereka tentang enjin jimat bahan bakar. Beberapa aspek utama dibincangkan dan dijelaskan dalam kertas kajian ini. Kertas soalselidik telah digunakan sebagai alat kajiselidik, yang telah dibahagikan kepada tiga bahagian, meliputi faktor kos, enjin dan operasi. Soalselidik ini dibentuk berpandukan skala Likert, dan telah diedar kepada responden yang telah dipilih secara rawak, di kalangan komuniti nelayan di Manjung, Perak. Maklumat yang diperolehi kemudiannya diproses menggunakan Pakej Statistik untuk Sains Sosial (SPSS). Dapatan menunjukkan bahawa para nelayan dalam kawasan persisiran laut tidak berpuas hati dengan motor enjin sangkut, dengan tahap keyakinan lebih daripada 95%.

Kata kunci: Perikanan Persisiran Pantai; Motor Enjin Sangkut; Penggunaan Bahan Api

INTRODUCTION

Coastal fisheries play an important role in generating business income and fish sources to low income community. The coastal fishing in Malaysia is classified as a small scale fishing sector. The operation area of fishing activity depends on the tonnage of the vessels and engine capacity. The Fisheries Comprehensive Licensing Policy (FLCP) has divided Malaysian Fishing waters into four zones. Inshore fishing zones are divided into three zones, as shown in Table 1. These management zones are established to control the allocation of resources between the fishing vessels to prevent conflict among fishermen. It also helps the government to preserve limited marine species from illegal activities.

TABLE 1. Fisheries zones (Department of Fisheries Malaysia 2015)

Zone A	Zone B	Zone C
0-5 nautical miles from shore, reserved for traditional fisheries below 20 GRT	5-12 nautical miles from shore, for commercial fisheries that use gear such as trawls and purse seiners below 40 GRT	12-30 miles from shore, for commercial fisheries that use boats above above 40 GRT up to 70 GRT

FIGURE 1. FRP fishing boat powered by outboard motor

Outboard motor was invented by Gustave Trouve (Karkanis et al. 2014) in early twenties. This type of engines is installed behind the boat at water interface. It is a one-module engine, consisting of engine, gearbox and propeller, mounted on the boat transom, as illustrated in Figure 2. There are several types of outboard motors available in the market (Zainol & Yaakob 2016). Conventional outboard motors such as long tail have been used since several decades ago (Zainol & Yaakob 2016). Technologies keep changing, with new outboard motors are introduced. The most popular is the standard 2-stroke gasoline engine, which exhibits several advantages, such as high speed, low weight, easy to install and saving of space (Wilson 1999). Outboard motors are designed for high speed and have the advantage of easy installation. High speed is important to reach fishing ground and return to port in short time, to ensure the fish catch supply to customer remain fresh.

However, the usual problem is only petrol outboard engine is available in the market. Petrol outboard engine has higher fuel consumption compared to diesel engine as mentioned by (Gulbrandsen 2012; Wilson 1999). As for many important fisheries, high fuel cost is a major constraint to economic viability. In coastal fisheries, fuel is the largest cost and can reach up to 50% although the actual proportion varies between fisheries (Behrendt 2014). Increasing fuel cost is making many fishing practices uneconomic and inefficient. With the concern on current fisheries status, factors affecting fishing efficiency need to be addressed. Factors affecting fishing efficiency can be classified according to a number of criteria with aim to reduce cost and maximize revenue of each trip. According to Marchal et al. (2007), fishing efficiency is frequently affected by some physical attributes of the operating vessel (engine power, gross tonnage), and is also dependent on other factors, including gear technology and on-board equipment, which are often ignored. This signifies that alongside fuel cost, other aspects are also important to be addressed to ensure the performance of outboard engine.

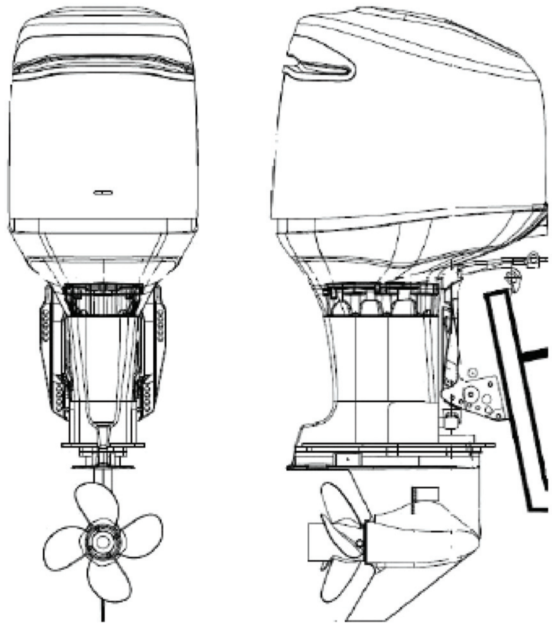

FIGURE 2. Typical outboard motor configuration

The performance of outboard motors can be identified based on various factors as discussed by Gulbrandsen (2012), Kurioka (2012), Marchal et al. (2007) Rothrock & Selden (1948), Valdemarsen, (2001), Wilson (1999), and Xue, Grift, & Hansen (2011). Gulbrandsen (2012), Kurioka (2012), and Wilson (1999) investigated the performance of outboard motor based fuel economy and cruising performance. A survey by Mazuki & Man (2014) among fishermen in Malaysia shows that the use of fishery technologies is not only to improve engine performance but also increase their fishing efficiency. Similar works had been done by (Rothrock & Selden 1948) and Xue et al. (2011) considering power performance, economy performance and durability. In 2001, Valdemarsen, (2001) found that engine selection depending on the fishing method and the targeted fish. It is known that fuel is an important running cost for several fishing methods and vital to consider during engine selection. However, the amount of fuel consumed by a vessel varies depending on many factors with regards to operational and technological aspects such as vessel condition, engine power, vessel speed and gear configuration, sea state and weather conditions (Davie et al. 2015). According to Behrendt (2014), energy consumption can be reduced by increasing the operational effectiveness of fishing vessels. Eigaard et al. (2014) revealed that technological improvements such as efficient electronic equipment, gear design, engines, deck equipment, and catch-handling procedures influence and improve the capture efficiency by 3.2% per year. Continuous technology improvement can help fishermen to increase the value of their catch, decrease costs, aid navigation, and improve safety at sea (Eigaard et al. 2014). Considering all of these factors, this study had been carried out to analyze the relation between outboard engine performance with these factors as previously mentioned. Hence, this research was done with aim to investigate fishermen satisfaction with regards to the performance of outboard motors for coastal fishing activities.

METHODOLOGY

The aforementioned factors have been summarized into three main elements, namely economic factor, engine system factor and operation factor. Questionnaire was developed as a survey tool, divided into three parts which are cost factor, engine system and operation factor. Survey was conducted by distributing questionnaires to inquire demographic profile and preliminary information. According to Kelley, Clark, Brown & Sitzia (2003), there are several approaches used to ensure quality of survey. Designing the research tool, whether using questionnaire or interview method, has to be carefully planned and piloted to ensure the quality and reliability of results. A research tool needs to be tested on a pilot sample of targeted population. Pilot study is an important aspect to be considered when developing questionnaires, to identify any inappropriateness and ambiguity with regards to the items used in questionnaire, as well as to test the internal consistency and reliability of the questionnaire. The reliability of the questionnaire can be determined by using Cronbach Alpha. A reliability coefficient of 0.70 or higher is considered acceptable in most social science situations, as recommended by SPSS (Cohen 1988). Cronbach Alpha reliability coefficient is typically used when there are several Likert type items to be summed to make a composite score or summated scale. Cronbach Alpha reliability coefficient is based on the mean or average correlation of each item in the scale with every other item. The questionnaire for this study was constructed based on Likert scale and was distributed to community of fishermen in Manjung, Perak.

The sample size was determined based on the population of 210 outboard powered fishing boats (Department of Fisheries Malaysia 2015). Through a random sampling, a total of 50 questionnaires had been distributed, and 30 questionnaires were retrieved. Even though only 30 responses were retrieved, these were sufficient and suitable for statistical analysis (Yurdugül 2008). The survey took almost two weeks to complete the data collection, and then processed using Statistical Package for Social Science (SPSS). SPSS was used to perform statistical analysis involving measuring mean, standard deviation, normality test and Chi-square test.

RESULTS

The results covered demographic, descriptive results and inferential analysis. The data from the demographic results had been used to examine the quantifiable subjects of selected population. The demographic results provided information on respondents' background such as name, age, location, year of experience, and contact number. Data such as year of experience of respondents signified the proficiency level of respondents to answer the addressed satisfactory issue and to ensure validity of gathered information. The results are presented in Figure 3, which show that 47% of the total respondents had involved in this fishing activity for more than 21 years.

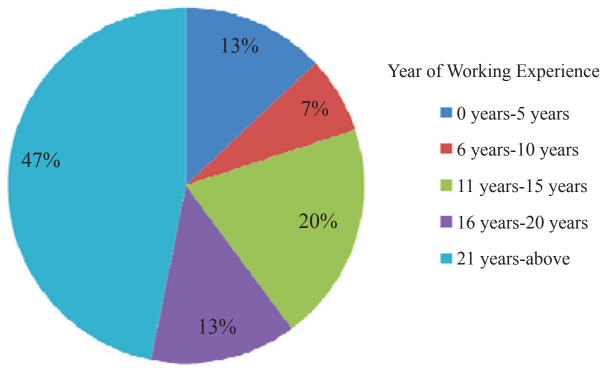

FIGURE 3. Working experience

Boat characteristics are part of non-demographic data, which were also investigated in this survey. This data contained additional information, such as horsepower of the engine, estimated service speed, approximate operating range, boat size, and type of fishing gears used. Figure 4 shows the results of survey of engine horsepower (HP). From a total of 30 respondents, 73% of respondents' engine capacities are in range of 40 to 65 HP, and nearly half of their boats are propelled using 60 HP engine.

Figure 5 shows the results of survey of estimated service speed. Most respondents' boats are equipped with portable GPS device for speed measuring and for searching for fishing ground area. It was found that 18 respondents often run their boat at around 26 knots, up to maximum speed of 30 knots.

Figure 6 illustrates the results of estimated range of operation. It can be seen from the chart that the approximate operating range for each respondent is varied and fairly distributed. Most respondents were unable to answer exactly because their fishing activity depends on weather and fish availability. However, most of them agreed that their favourite fishing ground is Pulau Sembilan, which is located about 30 nautical miles from the shore. This data reveals that speed is important to most respondents to reach fishing ground, and one of important factors in engine selection.

Figure 7 presents the results of type fishing gears used in inshore fishing. There are several types of fishing gears commonly used for inshore fishing, such as drift net, bag net

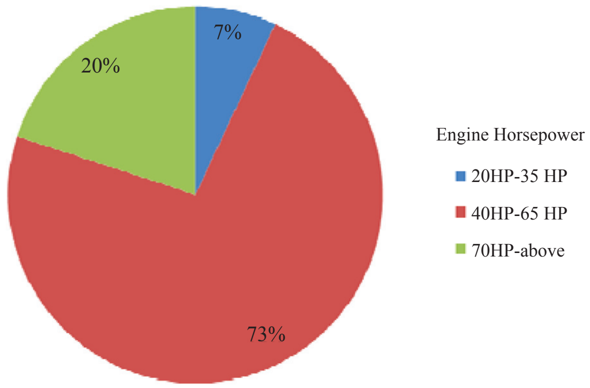

FIGURE 4. Engine horsepower

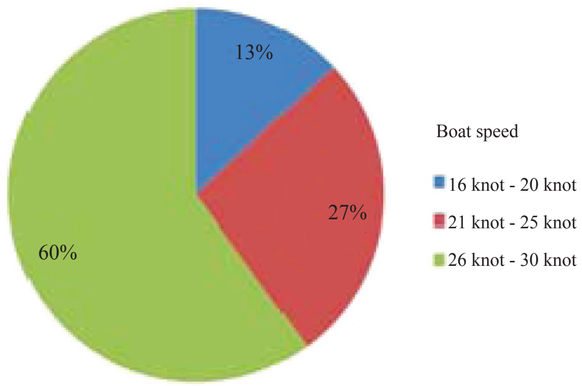

FIGURE 5. Boat speed

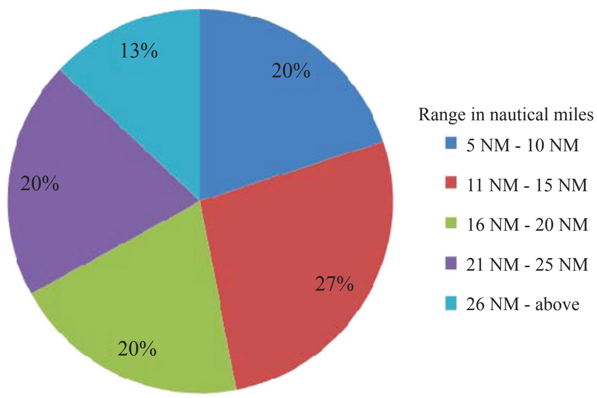

FIGURE 6. Operation range

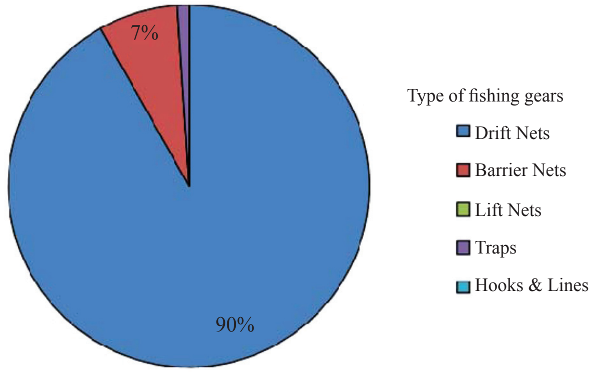

FIGURE 7. Fishing gears

and barrier net. Each of these fishing gears has influences on fishing operation and boat performance in terms of engine location and power used. The survey showed that 90% of respondents use gills net as fishing gears. Normally, gills nets are not affected by boat performance since they can be operated easily regardless of the condition of boats.

Descriptive analysis was used to determine the validity of the hypothesis on the perception and opinions of the fishermen on fuel economy, propulsion system, fishing operation and alternative propulsion system. The descriptive results contained fishermen's opinions on the current engine system and their concern about better fuel saving engine system.

The results of mean and standard deviation for each variable are shown in Table 2 to Table 5. The first part of questionnaire catered about economic element. Economic element is the effect of outboard engine to fishermen in terms of various costs involved. Table 2 shows the mean and standard deviation for economic element. The table shows that total mean is 1.09, whereas the standard deviation is 0.09. As the standard deviation is less than 1, the mean value of data could be accepted. Most respondents strongly agreed that they are burdened with the operation and maintenance costs, even though some of them received government subsidies. It can be deduced from the result that most fishermen strongly agreed on the burden of high operation cost of outboard engine and thus limiting their operating range. This finding is supported by Islam et al. (2016) who believe that the current fuel subsidy programme may not be an effective strategy for enhancing the income for coastal fishermen.

The second part of questionnaire catered about engine system element. This element was investigated to identify the fishermen's perception on the performance and reliability of their outboard engine. Table 3 shows the mean and standard deviation of this element. The table shows that total mean is 2.08, whereas the standard deviation is 0.21, which is generally acceptable.

Table 3 also shows that around 80% of respondents are not satisfied with their engine performance. With engine power less than 100 HP, most respondents are unable to go far from shore. They stated that they need more powerful engine to allow them to go further safely. According to Islam, Gazi et al. (2016), coastal fishing boats are relatively low powered and inefficient for fishing. However, most of them can only afford to purchase engines with less power than 100 HP due to price factor. This is because most coastal fishermen earn low income, which hinders them to upgrade the engine system. Similar finding was mentioned by Mazuki & Man (2014) who claimed that low income probably prohibits them from making any technologies improvement. Engine maintenance also causes problem to them, as 86.7%

TABLE 2. Mean and standard deviation for economic elements

No	Question	Mean	Standard Deviation
1	The cost of purchasing the engine does not burden me	1.10	0.31
2	The cost of purchasing the engine is not a burden because of the government subsidies	1.17	0.38
3	I do not feel burdened by the cost of fuel consumption.	1.00	0.00
4	I do not feel burdened by the cost of fuel because of the fuel subsidy given by the government	1.37	0.49
5	Withdrawal of fuel subsidy will not affect my economy	1.00	0.00
6	The fuel cost does not affect the operating range of the fish landing	1.00	0.00
7	I do not feel burdened by the cost of engine maintenance	1.00	0.00
8	Maintenance cost of engine does not affect the operating range of the fish landing	1.00	0.00
9	The cost of purchasing my boat is more expensive than other types of boats	1.20	0.41
	Overall	1.09	0.09

TABLE 3. Mean and standard deviation for engine elements

No	Question	Mean	Standard Deviation
1	I am satisfied with the performance of my engine system	2.07	0.45
2	The engine maintenance does not burden me	2.07	0.36
3	I am very satisfied with my engine power	1.93	0.45
4	My engine system is easily handled	2.00	0.37
5	The lifespan of my engine system is sufficiently long	2.00	0.26
6	My engine system is fuel-efficient	1.80	0.41
7	I did not choose the type of engine system based on low prices as a major factor	2.70	0.59
	Overall	2.08	0.21

of respondent agreed that maintenance for the engine is high. Another important element is engine efficiency, as all or 100 % respondents agreed that their engines are not fuel efficient, which strengthens the facts highlighted by previous study (Gulbrandsen 2012; Wilson 1999). In terms of engine selection, they had no idea to consider low prices engine as a factor that influences the selection of engine. Therefore, based on the descriptive results, the fishermen considered they are unsatisfied with performance of outboard engine.

The third part of questionnaire dealt with fishing operation. This element was investigated to measure the influence of engine performance towards fishing operation. This is to ensure that the fishing operation is not affected or facing any problem, and to help respondents to improve their fish catch efficiency. Table 4 shows the mean and standard deviation for this element. The table shows that total mean is 4.03, whereas the standard deviation is 0.27. The table also shows that around 93.3% of respondent agreed that type of engine affects fishing operation and operating range of fish landing. The same number of respondent also agreed that boat speed has significant effects to fishing operation. This results are in line as suggested by Zainol & Yaakob (2016) as reaching the fishing grounds and returning to port in the shortest time can enhance fishing efficiency. However, they highly disagreed that boat speed is more important than fuel saving. Regarding the operation elements, most fishermen agreed that operation of the boat is affected by boat performance. However, they highly agreed that type of engine does not affect fishing operation.

TABLE 4. Mean and standard deviation for operation elements

No	Question	Mean	Standard Deviation
1	The type of engine does not affect fishing operation	4.50	0.63
2	The type of engine affects the operating range of the fish landing	4.47	0.63
3	The boat speed affects the operation of the fish catch	4.60	0.62
4	Boat speed is more important than fuel saving	1.53	0.51
5	My boat is easy to handle during fish catch	4.53	0.57
6	The boat that I am using can be easily maintained	4.57	0.86
	Overall	4.03	0.27

The results of normality test showed that the p-value for three category variables was less than 0.05, and hence distribution data was abnormal. Based on the results of normality test, inferential analysis had been made based on non-parametric test. Chi square is one of non-parametric tests commonly used to test observed hypothesis. These are statistical techniques where any assumptions of normality for the population are not required. Chi-square results are tested based on significance level (α). For this study, the significance level (α) was set to be 0.05 – standard value that is commonly used in most research as the significance level criterion. The results of Chi-square test are shown in Table 5.

TABLE 5. Chi-square test results

	Economic	Engine System	Fishing Operation
Chi-Square	14.533[a]	34.400[b]	11.067[b]
df	3	6	6
Asymp. Sig.	.002	.000	.086

The level of significance, p, for all constructs except for operation is less than 0.05 (Cohen 1988) meaning that respondents agreed that they are burdened with the operation cost of outboard propulsion system and looking for alternative fuel saving propulsion system. Regarding construct fishing operation, the level of significance is 0.086, which is more than 0.05, meaning that fishing operation is influenced by type of propulsion system used.

DISCUSSION

The survey results indicate some important elements. The respondents agreed that operation cost of outboard motor is high, where fuel consumption rate can be considered as the main factor that triggers the high cost of operation. During the survey, most of fishermen shared their views on cost issues. Many of them asked for more subsidies or financial aid from government, which reveals that there is still a conventional mentality among the local fishermen to rely on government subsidy. Similar findings were also reported in various studies previously such as by Schuhbauer et al. (2017) and Sumaila et al. (2008). Surprisingly, the fishermen were not aware on the need of fuel efficient propulsion system, as petrol outboard engine is still being the preferred engine among inshore fishermen. This might be because they have no choice instead of depending on outboard motor, since no alternative is available. Sumaila et al. (2008) found that the fishermen keep using fuel-inefficient technology as they still can manage the fuel cost using given fuel subsidy. Outboard motor is an electronically controlled engine, which is initially designed for medium class boat, thus needs proper care. Lack of awareness on engine care such as engine exposure to weather can reduce its lifespan. Even though most of them have gained technical knowledge through experiences and are able to carry out simple maintenance of the outboard engine, they still depend on the supplier agent, and this cost them more in terms of maintenance cost. In addition, small propeller size of outboard motor requires more power for speed. This restricts some with small motors to go further safely. Hence, alternative propulsion system which provides better fuel saving and less maintenance is required.

CONCLUSION

Fishermen's views on the performance of petrol outboard motors in coastal fishing boats have been successfully discussed. The survey results show that inshore fishermen are not satisfied with petrol outboard motor and highly agree with the idea of alternative propulsion systems. From this study, alternative fuel savings engines are vital for the effort to reduce operation cost and significantly contribute to sustenance of fishermen livelihoods. Some suggestions can be considered to assist these fishermen, such as to provide them with proper engine training, modify existing engines to use cheaper natural gas as fuel, and use of inboard diesel engines which is proven to be more fuel saving.

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