Factor Analysis of Machine Selection in Aquatec Smart Ship Design for Fish Farming Using The SPSS Method

Analisis Faktor Pemilihan Mesin Pada Desain Aquatec Smart Ship Untuk Budidaya Ikan Menggunakan Metode SPSS

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ABSTRACT

In the manufacture of a floating building such as a ship requires a machine to be able to move. This study aims to analyze the factors that can influence the selection of engines that will have an impact on ship performance. The method was carried out through data collection which was distributed to 30 respondents. The analysis carried out includes validity and reliability. The results of the analysis were carried out in the form of an alpha value of more than 0.6 and a cronch's bach value of 0.705 so that the factors used were reliable. Where the factor that has the highest value is the calculation of resistance, namely 0.609. Next, the calculation of the resistance value is carried out to determine the engine power. The difference between the detainees through the help of the Maxsuf application and manual calculations is 0.91. So the results of calculating the power requirements of the Aquatec SMART ship design are 15 Hp.

ABSTRAK

Pada pembuatan sebuah bangunan apung seperti kapal memerluka mesin untuk dapat bergerak. Penelitian ini memiliki tujuan untuk menganalisis faktor yang dapat mempengaruhi pemilihan mesin yang akan berdapak pada performa kapal. Metode yang dilakukan melalui pengumpulan data yang disebarkan kepada 30 responden. Analisis yang dilakukan mencakup validitas dan reabilitas. Hasil dari analisis yang dilakukan berupa nilai alpha lebih dari 0,6 dan nilai cronch's bach 0,705 sehingga faktor yang digunakan realiabel. Dimana faktor yang memiliki nilai tertinggi berupa perhitungan tahanan yaitu 0,609. Selanjutnya dilakukan perhitungan nilai tahanan untuk menentukan daya mesin. Nilai selisih dari tahanan melalui bantuan aplikasi bantuan aplikasi maxsuf dan perhitungan manual adalah 0,91. Sehingga hasil dari perhitungan kebutuhan daya desain aquatec SMART ship yaitu 15 Hp.

INTRODUCTION

Sampang Regency has an area of 1233.33 km² and has fisheries potential that has high selling value (Hidayah & Suharyo, 2018). However, in 2015 - 2017 there was a decline in fish catches by 15%. This is because existing facilities cannot be optimized and people are reluctant to cultivate fish independently (Ustadi et al., 2022). Sampang is an area that passes through the Madura Strait so it has more than 20 different types of fish. But the fish that is suitable for Madura waters is grouper. This fish was chosen because it has a high selling price and is in demand by many people (Hur et al., 2020). In Ministerial Regulation No. 19 of 2021 article 3 in point b states that there has been a decline in the fish population in the last 5 years. Seeing the existing conditions, facilities are needed that can optimize fishermen's catches in the form of Aquatec SMART ships (Budiman et al., 2022). It is the latest innovation for fish farming, a fish attractant and can be used as a means of transportation (floating tourism).

Furthermore, to support the facilities, a machine is needed that can support the performance of the facilities used. The aim of this research is to find out factors that can be taken into consideration when purchasing machines in the realization of facilities and making it easier for fishermen to operate the equipment.

METHODS

This section presents information about the place and time of research, tools and materials used, research design used or hypothesis if any, clear research procedures, and data analysis used. This research uses quantitative methods, namely collecting data through the field. The following are the stages carried out (Arisandi & Sambah, 2022):
1. Survey and literature study
2. Sampling through respondents
3. Perform SPSS analysis

After carrying out the steps above, it is hoped that it will make it easier to carry out the analysis in this research.

RESULT AND DISCUSSION

In this research, an analysis was carried out that influences machine selection. There are several factors that can influence one of them as follows:
1. Main dimensions of the ship
2. Material used
3. Resistance calculation results
4. Form the bow section
5. Travel route
6. Function of the ship to be built
7. Type of hull used
8. The speed you want to achieve
9. Total DWT of the ship (Syarifuddin et al., 2022)

From the several factors above, a validity and reliability analysis will then be carried out. In our testing we used the help of the SPSS application in the analysis and can be seen in the image below.

Correlations

		Faktor 1	Faktor 2	Faktor 3	Faktor 4	Faktor 5	Faktor 6	Faktor 7	Faktor 8	Faktor 9	Total
Faktor 1	Pearson Correlation	1	.529**	.481**	-.191	.025	-.022	-.077	-.192	.014	.437*
	Sig. (2-tailed)		.003	.007	.312	.896	.910	.687	.308	.943	.016
	N	30	30	30	30	30	30	30	30	30	30
Faktor 2	Pearson Correlation	.529**	1	.194	-.154	.067	-.019	.166	.112	-.062	.458*
	Sig. (2-tailed)	.003		.305	.416	.725	.919	.380	.555	.747	.011
	N	30	30	30	30	30	30	30	30	30	30
Faktor 3	Pearson Correlation	.481**	.194	1	.230	.273	.359	-.009	-.037	.223	.609**
	Sig. (2-tailed)	.007	.305		.222	.145	.051	.962	.846	.236	<,001
	N	30	30	30	30	30	30	30	30	30	30
Faktor 4	Pearson Correlation	-.191	-.154	.230	1	.224	-.044	.287	.419*	.219	.405*
	Sig. (2-tailed)	.312	.416	.222		.233	.817	.124	.021	.245	.026
	N	30	30	30	30	30	30	30	30	30	30
Faktor 5	Pearson Correlation	.025	.067	.273	.224	1	.202	.238	.383*	.491**	.572**
	Sig. (2-tailed)	.896	.725	.145	.233		.285	.206	.037	.006	<,001
	N	30	30	30	30	30	30	30	30	30	30
Faktor 6	Pearson Correlation	-.022	-.019	.359	-.044	.202	1	.140	.113	.470**	.435*
	Sig. (2-tailed)	.910	.919	.051	.817	.285		.462	.551	.009	.016
	N	30	30	30	30	30	30	30	30	30	30
Faktor 7	Pearson Correlation	-.077	.166	-.009	.287	.238	.140	1	.495**	.213	.561**
	Sig. (2-tailed)	.687	.380	.962	.124	.206	.462		.005	.259	.001
	N	30	30	30	30	30	30	30	30	30	30
Faktor 8	Pearson Correlation	-.192	.112	-.037	.419*	.383*	.113	.495**	1	.291	.522**
	Sig. (2-tailed)	.308	.555	.846	.021	.037	.551	.005		.118	.003
	N	30	30	30	30	30	30	30	30	30	30
Faktor 9	Pearson Correlation	.014	-.062	.223	.219	.491**	.470**	.213	.291	1	.550**
	Sig. (2-tailed)	.943	.747	.236	.245	.006	.009	.259	.118		.002
	N	30	30	30	30	30	30	30	30	30	30
Total	Pearson Correlation	.437*	.458*	.609**	.405*	.572**	.435*	.561**	.522**	.550**	1
	Sig. (2-tailed)	.016	.011	<,001	.026	<,001	.016	.001	.003	.002	
	N	30	30	30	30	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Figure 1. Validity Results Through Correlation

Reliability Statistics

Cronbach's Alpha	N of Items
.705	10

Figure 2 Reliability Test Results

The results of the analysis carried out can be seen that all variables have reliable characteristics because they have an alpha value of more than 0.6. So that when choosing a machine, everything influences each other, but the thing that is significant is the third factor, namely the results of the resistance calculation according to the respondent's answers that have been carried out.

Validity and Reliability Methods

SPSS is a method for increasing quality or improving the quality of a product or work process (Dharmayanti et al., 2021). In the SPSS method itself there are several ways to

measure a variable that cannot be measured by tools. In this research, only validity and reliability methods were used (Fajar & Basuki, n.d.). The meaning of validity is measuring something to achieve the validity of the instrument so that this method can use correlation (Azhar, 2019). The definition of reliability is a measure that shows the consistency of a measuring instrument in measuring a variable or numerical value. There are several criteria for this test, namely (Ahmad et al., 2023):

1. If the alpha value is more than 0.60 then it is reliable
2. If the alpha value is less than 0.60 then it is not reliable
3. If the Cronch's Bach value ranges from 0-1, the greater the Cronch's Bach alpha value, the more reliable it is (Zein et al., 2019).

Below is a table of parameters used to determine the level of validity.

df = (N-2)	Tingkat signifikansi untuk uji satu arah				
	0.05	0.025	0.01	0.005	0.0005
	Tingkat signifikansi untuk uji dua arah				
	0.1	0.05	0.02	0.01	0.001
1	0.9877	0.9969	0.9995	0.9999	1.0000
2	0.9000	0.9500	0.9800	0.9900	0.9990
3	0.8054	0.8783	0.9343	0.9587	0.9911
4	0.7293	0.8114	0.8822	0.9172	0.9741
5	0.6694	0.7545	0.8329	0.8745	0.9509
6	0.6215	0.7067	0.7887	0.8343	0.9249
7	0.5822	0.6664	0.7498	0.7977	0.8983
8	0.5494	0.6319	0.7155	0.7646	0.8721
9	0.5214	0.6021	0.6851	0.7348	0.8470
10	0.4973	0.5760	0.6581	0.7079	0.8233
11	0.4762	0.5529	0.6339	0.6835	0.8010
12	0.4575	0.5324	0.6120	0.6614	0.7800
13	0.4409	0.5140	0.5923	0.6411	0.7604
14	0.4259	0.4973	0.5742	0.6226	0.7419
15	0.4124	0.4821	0.5577	0.6055	0.7247
16	0.4000	0.4683	0.5425	0.5897	0.7084
17	0.3887	0.4555	0.5285	0.5751	0.6932
18	0.3783	0.4438	0.5155	0.5614	0.6788
19	0.3687	0.4329	0.5034	0.5487	0.6652
20	0.3598	0.4227	0.4921	0.5368	0.6524
21	0.3515	0.4132	0.4815	0.5256	0.6402
22	0.3438	0.4044	0.4716	0.5151	0.6287
23	0.3365	0.3961	0.4622	0.5052	0.6178
24	0.3297	0.3882	0.4534	0.4958	0.6074
25	0.3233	0.3809	0.4451	0.4869	0.5974
26	0.3172	0.3739	0.4372	0.4785	0.5880
27	0.3115	0.3673	0.4297	0.4705	0.5790
28	0.3061	0.3610	0.4226	0.4629	0.5703
29	0.3009	0.3550	0.4158	0.4556	0.5620
30	0.2960	0.3494	0.4093	0.4487	0.5541

Figure 3. Validity Test Parameters

From the table above it can be seen that if the number of respondents is 30 people then,

df = n – 2 = 30 -2 = 28

The r value in the table is 0.3610

So it can be seen in the results table that it has a value of more than 0.3610, so all the factors carried out in the analysis can be stated as reliable variables or are very strongly interconnected, however, the one that has the highest value and can influence engine selection is the result of calculating ship resistance (Tabita et al., 2017).

Grouper

Grouper is a type of fish that has high economic value and is in demand by many people, especially in other countries. The largest recorded export in the fisheries sector is coral fish, one of which is grouper (Sunardi & Pamungkas, 2019). Grouper in rearing does not require a special place and special care so it is easy to cultivate. However, in 2017 - 2021 the number decreased by up to 20% (East Java KKP data 2021). Seeing the potential that exists but cannot yet be optimized properly, it is necessary to cultivate marine fish (Palupi et al., 2020). This can also support the government in carrying out the program, namely point 3, in the form of developing environmentally friendly coastal and land marine fisheries in the blue economy program towards Indonesia becoming a maritime axis (Amir et al., 2022).

Aquatec SMART Ship

Facilities that are environmentally friendly and easy to operate are a dream for fishermen around the coast of Madura (Made et al., 2023). In this research, we have an innovation to help the community in the form of an Aquatec SMART ship design which functions as a place for fish farming, not only that, this facility can also be used as a fish attractant and can be used as a tourist facility (Helminuddin & Oktawati, 2023). The following is a picture of the Aquatec SMART ship facility.

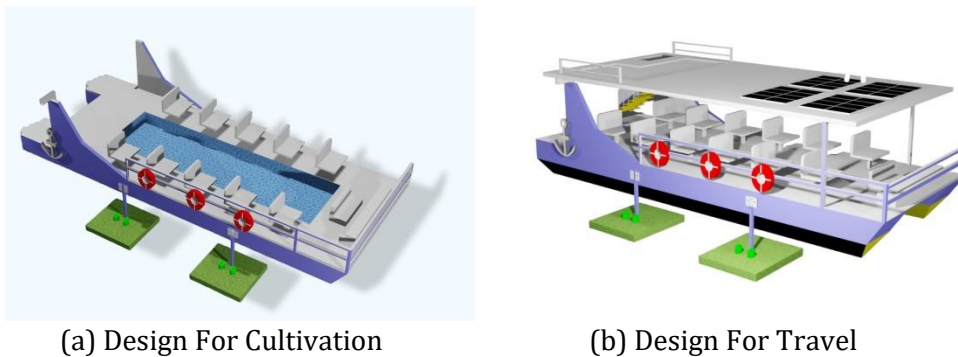(a) Design For Cultivation   (b) Design For Travel
Figure 4. Aquatec SMART Ship design

The design above is a 3D depiction that has been created where the ship's hull has a catamaran-like shape and is made from HDPE material. The selection of HDPE material was made to support the government in its blue economy program. This is because HDPE is an alternative material that is strong, environmentally friendly, resistant to sharp objects and easy to maintain. Not only that, HDPE is strong at extreme temperatures -24°C and at the highest temperature of 294°C (Aditya et al., 2022).

Prisoner Calculation

Calculating resistance is one of the stages in a design process. In this assessment, after testing the validity and reliability, the resistance calculation is a factor that greatly influences the choice of machine. So, the next calculation will be carried out to determine the engine speaker that will be used in the Aquatec SMART ship design. Determination of custody was carried out using the maxsuf application and had the following results (Zamdial et al., 2020).

Table 1 Prisoner Results with the Help of the Maxsuf Application

Speed (kn)	Froude No. LWL	Froude No. VOL.	Fung Resist. (kN)	Fung Power (kW)
6.500	0.311	1.077	13.47	98.55
6.750	0.323	1.119	14.67	106.51
7.000	0.335	1.160	15.81	114.54
7.250	0.347	1.202	15.85	122.53
7.500	0.359	1.243	17.73	130.13
7.750	0.371	1.284	18.31	131.79
8.000	0.383	1.326	18.48	132.89
8.250	0.395	1.367	20.18	133.05
8.500	0.407	1.409	21.44	134.24
8.750	0.419	1.450	22.39	135.81
9.000	0.431	1.492	23.17	136.34
9.250	0.443	1.533	24.94	137.47
9.500	0.455	1.574	25.81	138.70
9.750	0.467	1.616	26.86	139.57
10.000	0.479	1.657	27.15	139.67

Looking at the results of the resistance values, the next step will be to calculate the engine power requirements for the Aquatec SMART ship design. Power calculation as follows:

Manual calculation of total resistance

R_T = $R_w + 0.5 \times \rho \times S [C_f (1+k) + C_a] \times V^2$
R_T = 10.92
$R_{T\ service}$ = $R_T \times (1+20\%)$
$R_{T\ service}$ = $10.92 \times (1+20\%)$
$R_{T\ service}$ = 13.105 kN

From the results of manual resistance calculations because the hull used is a type of catamaran, the actual resistance is times 2, so the difference between the application resistance and manual calculation is 0.91. The next step is to calculate the engine power requirements and produce the following values (Hamidi et al., 2018).

Calculating BHP

$$BHP = \frac{SHP}{Effisiensi}$$
$$BHP = \frac{8,985}{0,98}$$
$$BHP = 9,168\ kw$$
$$BHP_{mcr} = \frac{SHP}{Effisiensi}$$
$$BHP_{mcr} = \frac{9,168}{0,85}$$
$$BHP_{mcr} = 10,78\ kw$$
$$BHP_{mcr} = 14,47\ Hp$$

According to the results of the BHP calculation, it can be seen that the required power is 15 hp.

CONCLUSSION AND SUGGESTION

Based on the results of the analysis carried out using the SPSS validity and reliability method as follows.

1. r = has a value of 0.368 and in the correlation table all factors have a value above r, so it can be stated that the factors above are reliable.
2. The alpha value is more than 0.6 so it is reliable
3. The Cronch's Bach value is 0.705, so it is reliable
4. The prisoner result using the help of the maxsuf application is 27.19 and the difference with manual calculations is 0.91
5. The result of calculating power requirements is 15 hp. (Hidayah & Suharyo, 2018)

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