2022_IOP_Nursan_Lobster_Scopus_Q4.pdf

by

Submission date: 15-Jun-2023 08:50PM (UTC-0500)
Submission ID: 2116985472
File name: 2022_IOP_Nursan_Lobster_Scopus_Q4.pdf (1.27M)
Word count: 4537
Character count: 23832

IOP Conference Series: Earth and Environmental Science

Table of contents

Volume 1107

2022

‹ Previous issue Next issue ›

2nd International Conference on Environmental Ecology of Food Security 19/05/2022 - 20/05/2022 Mataram, Indonesia

Accepted papers received: 26 October 2022
Published online: 14 December 2022

Technical efficiency analysis of pearl lobster (*Panulirus ornatus*) farming in East Lombok Regency using a Stochastic Frontier Approach

Technical efficiency analysis of pearl lobster *(Panulirus ornatus)* farming in East Lombok Regency using a Stochastic Frontier Approach

M Nursan[1], S Husni[1], N Wathoni[1], A F Utama FR[1], D Septiadi[1], M Syaputra[2], Sukarne[3], and F Ahmadi[1]

[1] Agribusiness Study Program, University of Mataram, Mataram, Indonesia
[2]Forestry Study Program, University of Mataram, Mataram, Indonesia
[3]Animal Science Study Program, University of Mataram, Mataram, Indonesia

E-mail: mnursan@unram.ac.id

Abstract. Pearl lobster is a fishery and marine commodity that has a high export value and the world demand for pearl lobster is still high. This is an opportunity for cultivators to increase pearl lobster production and productivity. The purpose of this study was to analyze the factors that affect the production of pearl lobster farming, analyze the level of technical efficiency and analyze the factors that affect the technical inefficiency of pearl lobster farming in East Lombok Regency. This research was conducted in Jerowaru and Pare Mas Villages, Jerowaru District, East Lombok Regency, which was determined by multi stages and purposive sampling method. This research includes descriptive research with a quantitative analysis approach. Respondents in this study were 45 pearl lobster cultivators who were determined by proportionally random sampling metod. Analysis of the data used in this study using the analysis of the Cobb Douglas production function stochastic frontier analysis (SFA). The results showed that the production of pearl lobster farming in East Lombok Regency was influenced by factors of cage area, feed, labor and pearl lobster seeds. The level of technical efficiency of pearl lobster farming cultivation is efficient, which a value is 87.86 percent. Then the factors that affect the technical inefficiency of pearl lobster farming in East Lombok Regency are age and education level, which have a negative effect.

1. Introduction

Indonesia is the largest archipelagic country in the world, with an ocean area of 5.8 million km2, has the longest coastline of 81,000 km, and has 17,508 islands [1]. Based on these data, the development of the Indonesian marine and fisheries sub-sector must be a priority in national development in order to increase fishery and marine production and the welfare of fishermen. The fisheries and marine sub-sector currently has a role in the country's economy, namely as a food-producing [2], raw materials for the fishing industry [3,4], and able to provide jobs for the community [2,5]. Therefore, the development of the fisheries and marine sub-sector needs to be directed at increasing employment opportunities for the community [6] and fishery production, one of which is through the cultivation of marine and fishery commodities [7,8].

Indonesia's marine aquaculture potential can reach 12,545,072 hectares, but only about 117,449 hectares are utilized [9]. Several types of fishery and marine commodities that are widely cultivated in Indonesia include snapper, grouper, milkfish, seaweed, lobster, and other types [10]. Lobster is one of the fisheries and marine sub-sector commodities that has economic value [11] and is one of Indonesia's main fishery and marine exports [12] because the price of lobster in the world market is relatively high, so it has become an attraction for entrepreneurs to export lobster [13]. The type of lobster that is widely cultivated in Indonesia is the type of pearl and sand lobster. Pearl lobsters are most in demand for cultivation because of their size and high selling price. The international market price of pearl lobster which has a size of 500 grams - 1 kilogram is valued at US$ 90-120 per kilogram [14,15].

The high export price of pearl lobster is an attraction for cultivators in Lombok Island, West Nusa Tenggara Province, to cultivate pearl lobster. Lobster cultivation in Indonesia has been carried out in floating net cages (KJA) since the 1980s [16] and began to be developed in Lombok waters in the 2000s [17,18]. Lombok waters were selected because it is the largest lobster seeds producing area in Indonesia [19]. Therefore, with the high availability of lobster seeds from nature which is easily obtained and caught in nature [20] lobster cultivation business in Indonesia, especially in the waters of the island of Lombok, has a great opportunity to be developed [21,22].

Catching lobster seeds on the island of Lombok is generally carried out in floating net cages using fishing media which are used by local residents. The place is known as “pocong” which is made of a plastic bag, and one end is tied with a rope. Pocong can also be in the form of used cement sacks which are shaped into fan-like folds and tied in the middle with a rope, then tied and hung on the edge of the floating net cage so that the pocong is positioned in the water column [17,23]. The most caught types of lobster seeds are sand and pearl lobsters, with more than 99 percent [24,25]. There are several seed-catching areas and pearl lobster cultivation in the waters of the island of Lombok, namely in the Central Lombok Regency, which includes the waters of Gerupuk Bay, Bumbang Bay, Awang Bay, and Selong Belanak waters, and in the East Lombok Regency area includes Ekas Bay, Seriwe Bay and Jukung Bay (Telong Elong area) [20,26].

Between the two areas, East Lombok Regency is the center of lobster cultivation and development in West Nusa Tenggara Province, with an area of 5,324.05 hectares of lobster cultivation [27]. However, in carrying out lobster cultivation, especially pearl lobster, production and productivity problems are still experienced by cultivators in East Lombok Regency. The productivity level of lobster farming is still relatively low at 2.8 kg per m3 with a density of about 9 lobsters per m3 for an average lobster size of 300 grams, while lobster productivity in Vietnam has reached 3.64 kg per m3 with a density range of around 6 lobster per m3 for an average lobster size above 600 grams [28]. The occurrence of production problems in pearl lobster farming can be caused by the inefficient use of production factors such as seeds, labor, cage area, and feed. If farmers can make efficiency in the pearl lobster cultivation business, the production will be optimal. According to [29], optimal production can be achieved by making efficient use of production factors. This study aims to analyze the production factors that affect the pearl lobster cultivation business, analyze the level of technical efficiency, and analyze the factors that affect the technical inefficiency of the pearl lobster cultivation business in East Lombok Regency.

2. Research method

2.1. Sampling method

The method used in this study is a descriptive research method with a quantitative approach [30]. The determination of the research area was carried out in multi-stages and purposive sampling methods. East Lombok Regency was chosen as the research area because it is the center of pearl lobster development in West Nusa Tenggara Province. Then at the sub-district level, Jerowaru District was selected, and at the

village level Jerowaru Village and Pare Mas Village were selected. The research respondents were 45 pearl lobster cultivators who were determined by proportional random sampling.

2.2. Data Collecting and analysis Method

The type of research data is the cross section. Collecting data using a survey method, namely conducting interviews using a questionnaire. After the data has been collected, it is analyzed using the Cobb-Douglas production function using a Stochastic Frontier Analysis Approach. It is used in this study to analyze the factors that affect pearl lobster farming, the level of technical efficiency, and the factors that affect the technical inefficiency of pearl lobster farming in East Lombok Regency. The equation of the *Cobb-Douglas* production function *stochastic frontier analysis (SFA)* pearl lobster Farming in East Lombok Regency is as follows [31]:

$$\text{Log } Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + (v_i - u_i) \quad (1)$$

Where:
Y = Pearl lobster production (Kg)
X_1 = Cage area (m^2)
X_1 = Labor (HKO)
X_1 = seeds (ekor)
X_1 = Feed (Kg)
β_0 = Constan
β_j = Parametre coefficient
j= 1,2,3,4
v_i = External random variable which is actually symmetrical and normally distributed ($vi - N(0, \sigma^2)$)
u_i = Internal random variables are assumed to affect the level of technical inefficiency whose distribution is half normal ($ui - N(0, \sigma_u)$).

Then to measure the level of technical efficiency, the following equation is used [31]:

$$TE = \frac{E(Y/U_i, X_1, X_2, X_3, X_4)}{E(Y^*/U_i = 0, X_1, X_2, X_3, X_4)} \quad (2)$$

Where:
TE = technical efficiency
$E\ (Y/\ U_i, X_i)$ = observation output
$(Y^*/U_i = 0, X_i)$ = output limit (*frontier*)

Then the technical inefficiency effect model by [31] was used to measure the level of technical inefficiency of pearl lobster rearing business in East Lombok Regency. The variable ui as the effect of technical inefficiency on lobster rearing aquaculture is assumed to have a semi-normal and independent distribution with N ($ui,^2$). The equation for the effect of technical inefficiency (ui) used in this study is as follows:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \omega_i \quad (3)$$

where:
U_i = effect of technical inefficiency
Z_1 = age (years)
Z_2 = level of education (years)

Z_3 = cultivation experience (years)
Z_4 = number of family dependents (persons)

The parameter values of the factors that affect the Cobb Douglas stochastic frontier production function and technical inefficiency are estimated simultaneously with the Frontier 4.1 program in 2 stages. The first stage is estimating the parameter β_j using Ordinary Least Square (OLS) method. The second stage is estimating all parameters β_0, β_j, varians u_i dan v_i using the Maximum Likelihood Estimator (MLE) method. The results of processing the *Frontier 4.1* according to Aigner *et al*. [32, 33, 34], will provide the estimated value of the variance in the form of the following parameters:

$$\sigma^2=\sigma_v^2+\sigma_u^2 \quad (4)$$

$$\gamma=\frac{\sigma_u^2}{\sigma_v^2} \quad (5)$$

The parameter of this variance can find the value of 0 until 1,The value of the parameter is the contribution of the technical efficiency effect in the total residual effect.

3. Result and discussion

3.1. Characteristic of respondens

In this study, the average age of the respondents was 40.60 years. This shows that the cultivators pearl lobster farming in East Lombok Regency are in the productive age. The average education level of the respondents is 8.53 years or at the junior high school level. The level of education can be related to the knowledge and skills of cultivators. The higher the level of education, the easier it is to adopt and adapt the latest technology in the pearl lobster farming in East Lombok Regency. The average respondent's business experience in pearl lobster farming is 6.18 years and the average number of family dependents is 3.11 people (Table 1).

Table 1. Characteristics of Pearl Lobster cultivators in East Lombok Regency 2021

Characteristics	Average
Age (Years)	40.60
Level of Education (Years)	8.53
Experience (Years)	6.18
Number of family dependents (people)	3.11

3.2. Factors affecting Pearl Lobster farming

Estimation factors that affect the production of pearl lobster farming in East Lombok Regency is carried out using the Cobb-Douglas production function Stochatic Frontier Analysis Approach with the maximum likelihood estimator (MLE) method. The results show that the production of pearl lobster cultivation is significantly at level 5 % influenced by factors of cage area, labor, pearl lobster seeds and feed (Table 2).

Table 2. The Result analysis of Factors affecting Pearl Lobster Farming in East Lombok Regency using the Cobb-Douglas production function Stochatic Frontier Analysis with the maximum likelihood estimator (MLE) method 2021.

Variables	Coefficient	Standar-error	t-ratio
Contant	-0.986	0.427	-0.231
Cage Area (X_1)	0.313*	0.055	5.691
Labour (X_2)	0.157*	0.049	3.226
Seeds (X_3)	0.088*	0.028	3.172
Feed (X_4)	0.462*	0.061	7.602
Sigma-square (σ^2)	0.011*	0.002	4.702
Gamma (γ)	0.037	1.804	0.020
L-R test	13.67		

Note =* significance level at alpha 5 percent.

Table 2 shows the sigma-square (σ^2) value of 0.011. This value is as expected because it is greater than zero and has a significant effect at the 5% alpha level, so it can be said that the model in this study is correct and the assumptions of internal factors (u_i) and external factors (vi_i) are normally distributed and independent [35]. The value of gamma (γ) is 0.037 and has no significant effect at 5 percent alpha level. This means that the technical inefficiency is not dominant effect on the production of pearl lobster farming in East Lombok Regency because it is heavily influenced by noise factors such as disease, weather, and others. The value of Sigma square (σ^2) in this study is in accordance with the findings of Susanti et al.,[36] and Nursan et al [11] who found that differences in the production of lobster farming are more influenced by noise factors such as disease, weather, and others. Conditions in the field indicate that many cultivators are found with lobster disease (milky disease). The ratio of the generalized-likelihood (LR) is 13.67, which is greater than the value of X^2 in the Code and Palm Tables of 11.91 with a 5 percent alpha level of significance [37]. This means that there is still an effect of efficiency and technical inefficiency of pearl lobster cultivators.

Based on table 2, the results of the analysis of the factors that affect the production of pearl lobster cultivation in East Lombok Regency using the *Cobb-Douglas production function with a stochastic frontier analysis approach* shows that the variables of cage area, labor, seeds, and feed have positive coefficients or elasticity values and significant effect on the production of pearl lobster at the 5 percent alpha level.

The coefficient value or elasticity of the cage area variable is 0.313, which means that if the cage area increases by 1 percent, it will increase the production of pearl lobster farming by 0.313 percent. This result is in accordance with Nursan [11] findings, that the number of cages has a significant effect on increasing the production of pearl lobster farming. The value of the coefficient or elasticity of labor is 0.157, which means that if the labor input is increased by 1 percent, the production of pearl lobster farming will increase by 0.157 percent. The coefficient value or elasticity of the pearl lobster seed variable is 0.088, which means that if the seed input increases by 1 percent, it will increase the production of pearl lobster farming by 0.088 percent. This is consistent with the Susanti research [36] and Nursan [11], that lobster seeds have a significant and positive effect on the production of lobster farming. Then the feed variable has the highest coefficient or elasticity value among other variables, which is 0.462, which means that if the feed increases by 1 percent, it will increase the production of pearl lobster farming by 0.462 percent. This result consistent with Susanti's research [36], that the feed variable has a significant effect to increase the production of lobster farming in Lombok Island.

3.3. The technical efficiency level of Pearl Lobster farming

The level of technical efficiency of the pearl lobster farming in this study was analyzed using the Cobb-Douglas production function with the stochastich frontier analysis (SFA) approach using the frontier 4.1 program introduced by [31]. Based on table 3, the technical efficiency (TE) level of pearl lobster farming in East Lombok Regency is 0.8786 (87.86 percent) with a minimum TE value of 0.7619 (76.19 percent) and a maximum TE value of 0.9961 (99.61 percent). The TE value of 87.86 percent is considered efficient (Table 3). This indicates that pearl lobster cultivators can still improve TE at the level of technology and available inputs by 11.80 percent (1-0.8786/0.9961). The difference in technical efficiency between cultivators is due to differences in the level of technology use and management of pearl lobster farming. The TE value in this study is lower than Susanti *et al.,*[36] which obtained a technical efficiency value of 91 percent and Nursan *et al.,* [11] with an TE value of 94 percent.

Table 3. Technical efficiency level of pearl lobster farming in East Lombok Regency 2021.

Level of Technical Efficiency (%)	Cultivator	
	Number (People)	Percentage (%)
0-10	0	0
11-20	0	0
21-30	0	0
31-40	0	0
41-50	0	0
51-60	0	0
61-70	0	0
71-80	5	11.11
81-90	26	57.78
91-100	14	31.11
Total	45	100
Maximum		99.61
Minimum		76.19
Average		87.86

3.4. Factors Affecting Technical Inefficiency of Pearl Lobster Farming

Based on the results analysis in Table 4, it is found that the factors that significantly influence the technical inefficiency of the pearl lobster farming in East Lombok Regency are age and education level. The coefficient value or elasticity of the cultivator's age variable is -0.009 and has a significant effect on the 5 percent alpha level. This means that the increase in the age of pearl lobster farmers will reduce the technical inefficiency of the pearl lobster farming. The value of the coefficient or elasticity of the education level variable is -0.015 and has a significant effect on the alpha level of 10 percent. This means that an increase in the level of education will reduce the technical inefficiency of the pearl lobster farming. These results are consistent with Susanti [36] and Nursan's research [11], they found that increasing the age and education level of the cultivator lobster farming can reduce the level of technical inefficiency.

Table 4. The results of the analysis of the factors that affect the technical inefficiency of pearl lobster farming in East Lombok Regency 2021.

Variable	Coefficient	Standard-error	t-ratio
Constant	0.452	0.172	2.631
Age (Z_1)	-0.009**	0.003	-2.943

Education level *(Z_2)*	-0.015*	0.008	-1.933
Experience *(Z_3)*	0.002	0.011	0.181
Number of family dependents *(Z_4)*	0.05	0.044	1.299

Note =** significance level at alpha 5 percent, * significance level at alpha 10 percent

Based on the results of this study, it can be recommended that in improving the technical efficiency of the pearl lobster farming , it can be done by expanding the cultivation area, adding lobster seeds, optimizing the use of labor and providing the right amount and quality of feed. The government can take a role in providing assistance in the form of floating net cages, quality feed assistance and increasing the knowledge and skills of cultivators through the provision of counseling and training.

4. Conclusion

1. The production of pearl farming in East Lombok Regency is significantly influenced by the variables of cage area, labor, seeds, and feed.
2. The level of technical efficiency (TE) of pearl lobster farming in East Lombok Regency was efficient, which TE value is 86.35 percent.
3. The factors that affect the technical inefficiency of pearl lobster farming in East Lombok Regency are age and education level which has a negative effect.

References

[1] Husni S, Yusuf M, Nursan M and Utama FR A F 2021 Socio-Economic Losses of Small Fishermen after Lobster Seeding Banning Policy (Case Study in Batu Nampar Selatan Village, East Lombok Regency) *J. Biol. Trop.* **21** 112–9
[2] Tibrani 2018 Peranan Subsektor Perikanan Dalam Menunjang Perekonomian Kabupaten Kampar Provinsi Riau *J. Agribisnis* **20** 206–17
[3] Yonvitner 2014 Bahan Baku: Urat Nadi Industri Pengolahan Perikanan Mikro Kecil dan Menengah *J. Risal. Kebijak. Pertan. dan Lingkung.* **1** 187–91
[4] Krisnafi Y, Iskandar B H, Wisudo S H and Haluan J 2017 Penentuan Prioritas Wilayah Kerja Untuk Peningkatan Pengawasan Perikanan di WPP NRI 711 *Mar. Fish.* **8** 211–21
[5] Triarso I 2012 Potensi dan Peluang Pengembangan Usaha Perikanan Tangkap di Pantura Jawa Tengah *J. Saintek Perikan.* **8** 65–73
[6] Nursan M, Nabilah S and Sari N M W 2020 Potensi dan Strategi Pengembangan Kawasan Minapolitan Kertasari Kabupaten Sumbawa Barat. *J. Ilm. Membangun Desa dan Pertan.* **5** 192–201
[7] Lubis E 2012 *Pelabuhan Perikanan* (Bogor: IPB Press)
[8] Ariani S, Mahyudin I and Mahreda E S 2014 Peranan Sektor Perikanan Dalam Pembangunan Wilayah dan Strategi Pengembanganya Dalam Rangka Otonomi Daerah Kabupaten Balangan *Fish Sci.* **4** 110–20
[9] Kementerian Kelautan dan Perikanan 2011 *Kelautan dan Perikanan dalam Angka Tahun 2011* (Jakarta: Pusat Data Statistik dan Informasi Kementerian Perikanan dan Kelautan)
[10] Utama M I C, Yustiati A, Andriani Y and Rostika R 2021 Lobster Cultivation in Indonesia and Vietnam : A Review *Asian J. Fish. Aquat. Res.* **13** 12–20
[11] Nursan M, Husni S, Yusuf M, Utama FR A F and Widiyanti N M N Z 2021 Technical Efficiency of Lobster (Panulirus sp) Farming in East Lombok Regency *J. Bi* **21** 1087 – 1095
[12] Boesono H, Anggoro S and Bambang A N 2011 Laju Tangkap dan Analisis Usaha Penangkapan Lobster (Panulirus Sp) dengan Jaring Lobster (Gillnet Monofilament) *J. Saintek Perikan.* **7** 77–87

[13] FAO 2017 *Globefish Monthly Trade Statistics* (Rome, Italy: Food and Agriculture Organization of United States)
[14] Hoc T D and Jones C 2014 (2014). Census of the lobster seed fishery of Vietnam *Proceedings of the International Lobster Aquaculture Symposium Lombok, Indonesia, 22–25 April 2014* (Lombok) pp 20–6
[15] Anh T L and Jones C 2015 Lobster seed fishing, handling and transport in Vietnam. Chapter 2.4. In: Jones, C.O. (Ed.), Spiny lobster aquaculture development in Indonesia, Vietnam and Australia *Proceedings of the International Lobster Aquaculture Symposium held in Lombok, Indonesia, 22–25 April 2014.* (Canberra: Australian Centre for International Agricultural Research) pp 31–5
[16] Direktorat Jenderal Perikanan Budidaya 2009 *Petunjuk Teknis Budidaya Lobster di Keramba Jaring Apung* (Jakarta: Direktorat Produksi Direktorat Jenderal Perikanan Budidaya Kementerian Kelautan dan Perikanan)
[17] Erlania, Radiarta I N and Sugama K 2014 Dinamika Kelimpahan Benih Lobster (Panulirus Spp .) di Perairan Teluk Gerupuk , Nusa Tenggara Barat : Tantangan Pengembangan Teknologi Budidaya Lobster *J. Ris. Akuakultur* **9** 475–86
[18] Priyambodo B and Sarifin 2009 Lobster Aquaculture Industry in Eastern Indonesia: Present Status and Prospects In Spiny Lobster Aquaculture in Asia-Pacific Region *Australian Centre for International Agricultural Research Prosiding* pp 36–45
[19] Bahrawi S 2014 Improving Puerelus catch in Indonesia *International Lobster Symposium* (Mataram)
[20] Priambodo B and Jaya I B M S 2009 Lobster aquaculture in Eastern Indonesia: Part I. methods evolve for fledgling industry *Global Aquaculture Advocate July/August* pp 36–9
[21] Jones C 2010 Tropical spiny lobster aquaculture development in Vietnam, Indonesia and Australia *J. Mar. Biol. Ass.* **52** 304–15
[22] Erlania, Radiarta I N and Haryadi J 2016 Status Pengelolaan Sumberdaya Benih Lobster Untuk Mendukung Perikanan Budidaya: Studi Kasus Perairan Pulau Lombok *J. Kebijak. Perikan. Indones.* **8** 85–96
[23] Priyambodo B and Bahrawi S 2015 *Puerulus assessment and survey inBanyuwangi East Java. Trip report 30 July to 2 August 2015., ACIAR FIS/2014/059 Expanding spiny lobster farming in Indonesia. Lombok: Marine Aquaculture Development Centre.* (Lombok: Marine Aquaculture Development Centre)
[24] Pahlevi R 2009 Potential for comanagement of lobster seacage culture: A case study in Lombok, Indonesia. In K. C. Williams (Ed.), Spiny lobster aquaculture in the Asia-Pacific region *Proceedings of an international symposium held at Nha Trang, Vietnam, 9–10 December, 2008.* (Nha Trang: ACIAR Proceedings 132 (p. 26). Canberra: Australian Centre for International Agricultural Research)
[25] Priyambodo B, Jones C M and Sammut J 2020 Assessment of the lobster puerulus (Panulirus homarus and Panulirus ornatus , Decapoda : Palinuridae) resource of Indonesia and its potential for sustainable harvest for aquaculture *Aquaculture* **528** 1–17
[26] DKP NTB 2015 *Kajian/Analisis Pengelolaan Benih Lobster (Panulirus spp.) di Provinsi Nusa Tenggara Barat* (Mataram: Dinas Kelautan dan Perikanan Provinsi Nusa Tenggara Barat)
[27] [DKP] Dinas Kelautan dan Perikanan Kabupaten Lombok Timur 2021 *Profil Singkat Usaha Budidaya Lobster di Kabupaten Lombok Timur (Kawasan Teluk Jor/Jukung dan Teluk Ekas Kecamatan Jerowaru Kabupaten Lombok Timur)* (Selong)
[28] Petersen E H and Phuong T H 2010 Tropical Spiny Lobster (Panulirus ornatus) Farming in Vietnam—Bioeconomics and Perceived Constraints to Development *Aquac. Res.* **41** e634–e642
[29] Mayashinta W and Firdaus M 2013 Faktor-Faktor yang Memengaruhi Total Factor Productivity Industri Pertanian Indonesia Periode 1981-2010 *J. Manaj. Agribisnis* **10** 90–7

[30] Sugiono 2017 *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (Bandung: Alfabeta)
[31] Coelli T, Rao D S P and Battese G E 2005 *An Introduction to Efficiency and Productivity Analysis. Second Edition.* (New York: Springer)
[32] Aigner D J, Lovell C A K and Schmidt P 1977 Formulation and Estimation of Stochastic Frontier Production Function Models *J. Econom.* **6** 21–37
[33] Jondrow J, Lovell C A K, Materov I S and Schmidt P 1982 On the estimation of technical inefficiency in the stochastic frontier production function model *J. Econom.* **19** 233–8
[34] Greene W H 1993 *The Econometrics Approach to Efficiency Analysis* (New York: Oxford University Press)
[35] Ojo M, Mohammed U, Ojo A and Olaleye R 2009 Return to Scale and Scale, Determinants of Farm Level Technical Inefficiency Among Small Yam Based Farmers in Niger State, Nigeria: implication for food security Development *Int. J. Agric. Econ. Rural Dev.* **2** 43–51
[36] Susanti E N, Oktaviani R, Hartoyo S and Priyarsono D S 2017 Efisiensi Teknis Usaha Pembesaran Lobster di Pulau Lombok, Provinsi Nusa Tenggara Barat *J. Manaj. Agribisnis* **14** 230–9
[37] Kodde D A and Palm F C 1986 Wald Criteria for jointly Testing Equality and Inequality Restrictions *Econometrica* **54** 1243–8

2022_IOP_Nursan_Lobster_Scopus_Q4.pdf

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11