Technical Efficiency Analysis of Home Industry Kamang Crackers in Kenagarian Kamang Hilir Kamang Magek District, Agam Regency, West Sumatra Province

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Abstract

Technical efficiency is the ability of an industry to use minimum total input to produce maximum output. This research aims to 1) Analyze the level of technical efficiency in the Kamang cracker home industry in Kamang Hilir Kenagarian, and 2) Analyze what factors influencing the level of technical efficiency in the Kamang cracker home industry in Kamang Hilir Kenagarian. This research was carried out deliberately in Kenagarian Kamang Hilir, Kamang Magek District, Agam Regency. Respondents in this study using the Slovin formula, totaling 51 Kamang cracker home industry entrepreneurs using a simple random sampling technique. Using primary and secondary data, while the data analysis used is qualitative descriptive analysis and the Cobb-Douglass production function method which is converted into logarithmic form, then data analysis uses Stochastic Frontier. The analysis results showed that the average level of technical efficiency was 0.5792, proving that the hypothesis in this research was proven correct. Can be concluded that the Kamang cracker home industry is technically efficient and the factors that influence technical efficiency are raw materials, salt, hours people work, age, number of family members while green onions, pertalite and gas fuel, education, business experience are not significant in the Kamang cracker home industry.

Keyword: *kamang crackers, stochastic frontier, technical efficiency.*

1. INTRODUCTION

West Sumatra has an economic structure dominated by the agricultural sector, one of which is Agam Regency. One of the agricultural product commodities that makes Agam Regency the largest after Lima Puluh Kota Regency is cassava (Badan Pusat Statistik Sumatera Barat, 2021). Cassava has high economic value so that it has the potential to be developed (Rahmi, 2014). This condition can be seen from the many new innovations developed by the food industry as a business field, one of which is processed crackers made from cassava. The crackers that are a typical food from Kamang Magek District, Agam Regency are Kamang crackers.

Kamang crackers are a regional specialty food in Kamang Magek District, Agam Regency. During the production process, the Kamang cracker home industry still uses traditional tools, the price of raw materials fluctuates, the price of fuel is increasing, the location of the purchase of auxiliary materials is far away, and the workers come from their own families. All of these factors affect the amount of production and technical efficiency of the Kamang cracker home industry. In everyday practice, manufacturers will only realize that technical efficiencies are visible when their perceived deficiencies result in measurable losses. In general, inefficiency that lasts for a long time is clearly detrimental, due to the waste of resources that are increasingly difficult to obtain (Tajerin, 2004).

The use of optimal production factors is expected to maximize the production of Kamang crackers. However, from the results of the initial survey in this research, the use of 100% cassava raw material on average only produces 40-50% of Kamang crackers which should have a standard yield of >50%. This loss is caused by reduced water content, the process of peeling sweet potatoes which is still manual, the packaging process which still requires cutting the edges of raw crackers. Meanwhile, the cassava variety used is yellow cassava with a chewier cassava texture than other

cassava. This causes the yield of raw material for Kamang crackers to suffer a lot of losses, so it becomes a benchmark for the extent to which production inputs can be used to produce optimal production so assessing technical efficiency becomes important. One way to measure technical efficiency is to use the Cobb-Douglasss stochastic frontier method, which is a method to determine the efficiency and combination of the use of several production factors, as well as analyzing whether the Kamang cracker production factors have been running efficiently with production. variable. factors as influencing factors (Thermolen et al, 2016).

Novelty in research is the object studied, research time and research location. The history of Kamang crackers has been produced since 1940 during the Belada Colonial period (Andini, 2017) but there has been no significant innovation so it is necessary to analyze the technical efficiency of the business. Based on this explanation, it is important to carry out research with the aim of 1) Analyzing the level of technical efficiency in Kamang cracker home industry in Kenagarian Kamang Hilir. 2) Find out what factors influence the level of technical efficiency in the Kamang cracker home industry in Kenagarian Kamang Hilir.

2. RESEARCH METHODS

The location of this research was chosen purposively, namely in Kenagarian Kamang Hilir, Kamang Magek District, Agam Regency. The research time was held on December 21, 2022 - January 21, 2023. The number of Kamang cracker *home industries* in Kamang Hilir Kenagarian totals 103 home industry which are the population in this study. The sample size was determined using the Slovin formula from Sugiyono (2016). There are 51 home industries that will be interviewed and used as sample in this study as respondents. The sample in this study used simple random sampling technique and this sampling was carried out by random sampling technique.

This study uses two types of data, namely primary data obtained through interviews using a questionnaire. Secondary data was obtained through literature study. Technical efficiency was analyzed using stochastic frontier. According to Yoko (2014), technical efficiency can be measured by applying frontier model production efficiency using Cobb-Douglass model. The frontier production function for Kamang cracker production is assumed in the Cobb-Douglass equation made in the following equation:

$$Y = \alpha + \beta_1 BB + \beta_2 BP_1 + \beta_3 BP_2 + \beta_4 BBK_1 + \beta_5 BBK_2 + \beta_6 TK + V_i - U_i \quad (1)$$

To relate production factors, the first equation is converted into logarithmic form (Ln) because it uses the Cobb-Douglass model.

$$LnY = \alpha + \beta_1 LnBB + \beta_2 LnBP_1 + \beta_3 LnBP_2 + \beta_4 LnBBK_1 + \beta_5 LnBBK_2 + \beta_6 LnTK + V_i - U \quad (2)$$

Description:

Y : Kamang cracker production
BB : Raw Material (Kg)
BP_1 : Scallion Auxiliary Materials (Kg)
BP_2 : Salt Auxiliary Material (Kg)
BBK_1 : Gas Fuel (Kg)
BBK_2 : Pertalite Fuel (Kg)
TK : Labor (JOK)
Vi : Error in Production
Vi : Error in Production
B : Estimatedvariable parameter
α : Intercept

The model used to estimate the factors that influence the sources that cause technical efficiency is done with the econometric model approach from Sugiyono (2010) as follows :

$$TE_i = \alpha_0 + \alpha_1 U_i + \alpha_2 LP_i + \alpha_3 PU_i + \alpha_4 JAK_i + \alpha_5 M_i + u_i \quad (3)$$

Description:

TEi		: Technical efficiency
U	(α1)	: Age (year)
LP	(α2)	: Years of Formal Education (years)
PU	(α3)	: Business Experience (years)
JAK	(α4)	: Number of Family Members (person)
M	(α5)	: Cracker size (cm)
Ui		: *Errorterm*

Both models of production factors and technical efficiency are analyzed at once with the one step method. The one step method is a method of analyzing variables of production factors and variables of technical efficiency factors simultaneously (Darmawan, 2016). Meanwhile, according to Wang (2002) Consider a stochastic frontier model with one-sided efficiency suppose that the scale u depends on several variables (characteristics of a business) or variables Zs called the "one step" model determines the stochastic frontier and the way u depends on z, and can be estimated in one step simultaneously. In this research, the size of Kamang crackers is one of the production factors that is estimated to influence time efficiency.

3. RESULTS AND DISCUSSION

Kamang crackers are prepared with two additional ingredients, leek and salt. According to Geivanni (2017) the processing process for Kamang crackers is as follows:

1) Preparation of raw cassava, leek and salt.
2) Peeling and cutting, cassava is peeled and cut into pieces then rinsed until clean.
3) Boil the cassava which has been cleaned and then boiled.
4) Pounded, cassava that has been put into the machine.
5) After grinding, the cassava that has been ground slightly is then separated from the fiber, then put into a grinding machine, and mixed with all the additional ingredients, namely leek and salt.
6) Printing, when printing the dough, print it using a milk can or you can also use a plastic cup.
7) Drying, the material that has been printed is then placed on the samia to be dried or dried.
8) The drying process is carried out traditionally by heating directly under sunlight.
9) Packaging, after the mixture is dry, the crackers are ready to be packaged.

The characteristics of Kamang Crackers Home Industry Business Actors in Kamang Hilir Kenagarian can be explained as follows.

Table 1. Characteristics of Kamang Crackers Home Industry Business

No.	Description	Number (person)	Percentage (%)	Average
1.	Age (Year)			
	a. < 15	-	-	48.72
	b. 15 – 64	49	96.08	
	c. > 64	2	3.92	
2.	Years of Formal Education (Years)			
	a. 0 – 5	3	5.88	
	b. 6 – 10	14	27.45	10.41
	c. 11 – 15	33	64.71	
	d. 16 – 20	1	1.96	
3.	Business Experience (Years)			
	a. < 10	11	21.57	
	b. 10 – 20	29	56.86	15.29
	c. > 20	11	21.57	
4.	Number of Family Members (people)			
	a. 1 – 5	45	88.23	4
	b. 6 – 10	6	11.77	

Source: processed primary data (2023)

The characteristics of the Kamang cracker home industry business actors studied in this study in the form of the age of business actors. The average age of business actors is 48.72 years. There are no Kamang cracker home industry business actors under the age of 15, because at that age they fall into the less productive category and have not been able to consistently carry out the Kamang cracker home industry business. Age that is still productive will affect the physical condition, and labor in carrying out work activities. The higher the age of the business actors, the less efficient they are in running their farms, because the older the age, the work ability and technical ability will decrease and have a negative impact on technical efficiency (Maryanto et al, 2018). The results of this study are in line with the research obtained by Andini (2017) where the majority of kamang crackers business actors in Kamang Hilir Kenagarian have a productive age with a percentage (90%) of the total business actors.

The education of most Kamang cracker home industry business actors is at the level of 11 - 15 years as many as 33 people (64.71%) with an average of 10.41 which means high school level The average education of all business actors is 10.41 or the equivalent of the second grade of high school, however, it can be assumed that the education of Kamang cracker home industry business actors graduated from formal education at the junior high school level. The level of education is not significant or has no effect on the Kamang cracker home industry business. The results of this study are different from the research obtained by Primalasari et al (2019) where a high level of education will have a positive impact on the ability of smoked skipjack fish craftsmen to run their business.

The business experience of business actors in making Kamang crackers is ranging from 10 to 20 years as many as 29 people (56.86%). The results of the study are in line with the research obtained by Triana et al (2017) where the majority of Kamang crackers business actors in Kamang Magek District have business experience ranging from 10-20 years (58%) of the total respondents with an average business experience of 15.29 years. Experience is the most important capital in a business. The longer a business person has experience in the Kamang cracker business, the higher the knowledge and technical skills in making Kamang crackers which will later influence the technical success of the business.

The number of family members of each business actor mostly ranged from 1 to 5 people / family as many as 45 people (88.23%) with an average family size of 4 people. The results of this study are the same as those obtained by Andini (2017) where the average number of family members of kamang crackers business actors in Kamang Hilir Kenagarian is 1 to 3 people (75%) of the total respondents. According to Ukpong and Idiong (2013), the number of family members will significantly affect technical efficiency.

Technical Efficiency Level of Kamang Crackers Home Industry in Kamang Hilir Kenagarian Technical efficiency is defined by being able to systematically calculate deviations or measurements in the quantity of inputs used and the quantity of outputs produced by an industry (Lamusa, 2009). Based on the output results of the Frontier 4.1c software, it was found that the estimation results of the technical efficiency level of the Kamang cracker home industry in Kamang Hilir Kenagarian used 51 business respondents.

The level of technical efficiency of the frontier production function in the Kamang cracker home industry from each respondent of the Kamang cracker home industry business actors can be categorized, so that the lowest efficiency level to the highest efficiency level achieved by each Kamang cracker home industry business actor can be known. In accordance with the opinion of (Coelli, 1998), that estimating efficiency using the frontier production function allows the level of efficiency that has been achieved by each individual business actor in the Kamang cracker home industry to be known.

Information about the estimation results of Frontier 4.1c software obtained from the Maximum Likelihood Estimation (MLE) of the distribution of the level of efficiency achieved by the Kamang cracker home industry *is* presented in graphical form in Figure:

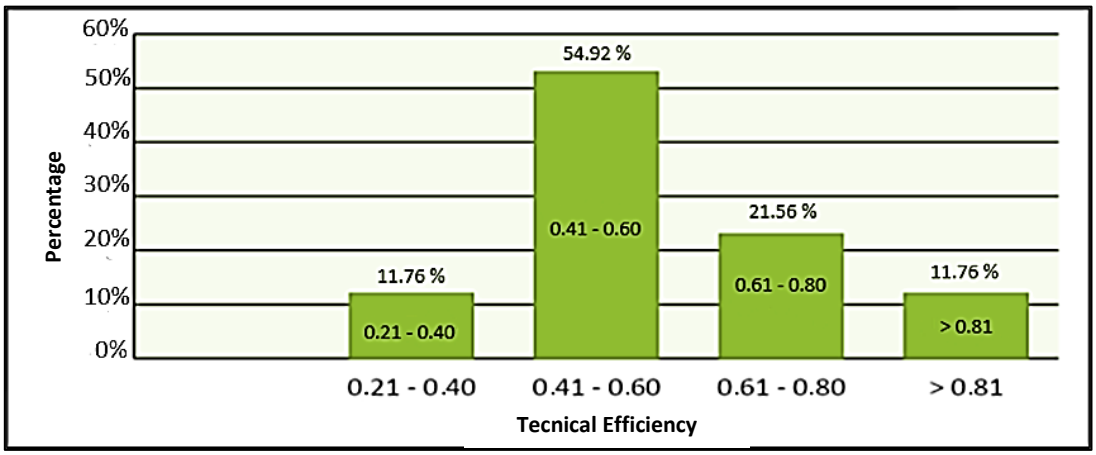

Figure 1. Technical Efficiency Level

Based on the figure above, the level of efficiency that can be achieved by respondents in the research area ranges from 0.21 - 0.99 with the highest proportion in the category of efficiency level > 0.41 - 0.60 with a percentage of 54.92% as many as 27 business people. The average technical efficiency level is 0.5792. This proves that the hypothesis in this study, namely the efficiency level of the Kamang cracker home industry *is* efficient, has been proven correct. So it can be concluded that the Kamang cracker home industry *is* technically efficient. However, in this case, the Kamang cracker home industry which produces crackers with an average of 465 kg / month has a potential production of an average of 802.83 kg / month with a proportion of 83.25% with a difference of 25.25% increase. The results of this study are in line with the results of research obtained (Primalasari et al., 2019) on the Smoked Skipjack Fish business which has an average technical efficiency level of 96.17% which is very technically efficient.

3.1 Factors Affecting the Level of Technical Efficiency

The Kamang cracker production process has several production inputs including: raw materials cassava, supporting materials consisting of: salt and green onions, fuel consisting of gas and pertalite, and worker's jam. There are several production factors that influence the production of Kamang crackers, including: age, education, experience, number of family members and management. The estimation results can be explained in the following table.

Table 2. Technical Efficiency Estimation Results

No	Variables	Parameters	Coefficient	Standard Error	T-count
1	Kostanta	(β0)	5.555	0.262	21,.149***
2	Raw material requirements (X1)	(β1)	-0.000	0.000	-10.561***
3	Salt (X2)	(β2)	0.202	0.085	2.375**
4	Leek (X3)	(β3)	0.000	0.000	0.604 ns
5	Gas Fuel (X4)	(β4)	0.926	0.133	0.691 ns
6	Pertalite (X5)	(β5)	0.000	0.000	0.015 ns
7	Working hours/month (X6)	(β5)	0.502	0.155	3.229***
8	Age (Y1)	(Δ1)	-0.000	0.000	-4.303***
9	Education (Y2)	(Δ2)	-0.152	0.096	-1.590 ns
10	Business experience (Y3)	(Δ3)	-0.000	0.000	-0.581 ns
11	Number of Member K (Y4)	(Δ4)	-0.294	0.104	-2.819***
12	Management (Y5)	(Δ5)	-0.000	-0.000	-2.624**
	log likelihood function OLS= -1.9247				
	log likelihood function MLE = 0.1668				

Source: processed primary data (2023)

Table = 1% = 2.70,
5% = 2,02,
10% = 1,68

Notes: *** = significant at α = 1% * = significant at α = 1%
** = significant at α = 5%
ns = non-significant

The following is an explanation of the level of technical efficiency in the Kamang cracker home industry in Kamang Hilir Kenagarian:

3.2 Raw Materials

The level of technical efficiency of the raw material variable, from the processed frontier results, shows that the use of cassava raw materials has a level of technical efficiency at the 99% confidence level or at a significant α 1% on the Kamang cracker home industry business with a negative coefficient (-). This shows that the addition of raw material inputs has a maximum limit used in the Kamang cracker production process. If the addition of raw materials exceeds the maximum limit, it will cause a decrease in efficiency. This is different from the research obtained by (Primalasari et al., 2019) if there is an increase in raw materials, it will increase the production output of smoked skipjack fish business. This is different from the research obtained by Susanto, et al (2014) that raw materials are the main component so that if there is no supply of raw materials, it will interfere with the production process.

3.3 Auxiliary Materials

The technical efficiency level of the auxiliary material variable consists of 2 materials, namely salt auxiliary materials and leek auxiliary materials. The amount of use of salt auxiliary materials has a level of technical efficiency at a confidence level of 95% or at a significant α 5% with a positive coefficient (+). This means that if there is an addition of a certain amount of salt, it will increase the technical efficiency of the Kamang cracker home industry. Meanwhile, the use of leek auxiliary materials has a non-significant technical efficiency level for the Kamang cracker home industry. This shows that the addition of leek auxiliary materials will not increase the efficiency of the Kamang cracker home industry. The leek variable is in line with the research obtained by (Primalasari et al., 2019) on the use of woka leaves as an auxiliary material, if there is an addition of leek auxiliary materials, it will not increase the production output of smoked skipjack fish business.

3.4 Fuel

The technical efficiency level of fuel consists of 2 materials, namely gas fuel and pertalite fuel. The processed frontier results show that the use of gas fuel has a non-significant efficiency level for the Kamang cracker *home industry* business with an estimation result of 0.691. This shows that if there is an increase in gas fuel or will not increase the efficiency of the Kamang cracker home industry business. This shows that the gas variable is in line with the research obtained by (Primalasari et al., 2019) on fuel use, if there is an increase in fuel, it will not increase the production output of smoked skipjack fish business.

The use of pertalite has a non-significant technical efficiency level for the Kamang cracker home industry with an estimation result of 0.015. This shows that if there is an addition of pertalite material, it will not increase the efficiency of the Kamang cracker home industry business. This shows that the gas variable and the pertalite variable are in line with the research obtained by (Primalasari et al., 2019) on the use of fuel, if there is an increase in fuel, it will not increase the production output of smoked skipjack fish business.

3.5 Working Hours

Man-hours for each month have a significant effect on the technical efficiency of Kamang crackers, with an efficiency analysis value of 3.229, which means that Thit is higher than Ttab, so the variable of man-hours has a significant effect on the amount of Kamang cracker production. The more labor used, the less time it takes to produce Kamang crackers per production period or the longer the production time, the more Kamang crackers can be produced. The results of the research on the number of people working are closely related to working hours which are not in line or different from the results of the research obtained by Primalasari, et al (2019) that labor as an auxiliary material has no effect on increasing the production output of smoked skipjack fish business. Based on field phenomena, the labor that is widely used comes from their own families, such as the children of business actors who help the Kamang cracker production process after school to streamline time.

3.6 Age

Age has a significant effect on the level of technical efficiency of the Kamang cracker home industry at a significant level of 1% with a value of -4.303, which means that Thit is higher than Ttab, so the variable hours of work has a significant effect on the amount of Kamang cracker production, because age affects a person's maximum ability to work at a certain age and will decrease skills at a certain age because the older a person is, the less energy in carrying out an activity in the production of the Kamang cracker production process. The results of this study are in line with the results of research obtained by Sukiyono and Romdhon (2016) that the age variable has a real influence on the capture fisheries industry in Bengkulu Province. Tinaprilla (2013) stated that the older a person's age will cause efficiency to be low.

3.7 Education

Education has an insignificant influence on the efficiency level of the Kamang cracker home industry. Education has an analysis value of -1.590, which means that Thit is lower than Ttab, so the

education variable has no real effect on the technical efficiency of Kamang crackers. This is because the level of education of business actors in the research location does not affect their ability to produce Kamang crackers. The results of this study are in line with Sukiyono and Romdhon (2016) that the education variable has no real influence on the capture fisheries industry in Bengkulu Province. In line with Tinaprilla's research (2013), it states that education has no real effect on efficiency. Education has a non-significant level of efficiency with a negative coefficient (-) on the Kamang cracker home industry business. This shows that the education of Kamang crackers home industry business actors if there is an increase in the level of education will not increase the efficiency of the Kamang crackers home industry business.

3.8 Business experience

The technical efficiency level category of the business experience variable, the processed frontier results show that business experience has a non-significant technical efficiency level for the Kamang cracker home industry business. Experience has an analysis value of -0.581, meaning that Thit is lower than Ttab, so the business experience variable does not significantly affect the technical efficiency of Kamang crackers. This shows that the business experience of the Kamang cracker home industry business actors if there is an increase in the length of business experience will not increase the efficiency of the Kamang cracker home industry business. The business experience of the Kamang cracker home industry business actors is long enough but does not have an impact on the level of efficiency because the work done from time to time is the same. The results of this study are the same as the results of the research obtained by Primalasari et al., (2019) that business experience has no effect on increasing the production output of smoked skipjack fish businesses. While the results of this study are not in line with the research obtained by Sukiyono and Romdhon (2016) that the skipper's experience should improve his ability to manage fishing vessels, which in turn will increase technical efficiency.

3.9 Number of Family Members

The number of family members has a significant effect at 1% alpha with an analysis value of -2.819 which means that Thit is higher than Ttab, so the number of family members has a real effect on the technical efficiency of Kamang crackers. This is because the average number of family members obtained at the research location is 3-4 people. This is different from the research obtained by Primalasari et al., (2019) which states that the more the number of family members of smoked skipjack fish craftsmen, the higher the level of technical efficiency. Because the more the number of family members the more labor can be involved in processing smoked skipjack fish. Penambahan jumlah anggota keluarga memiliki batas maksimal dalam proses produksi kerupuk Kamang. If the addition of family members exceeds the maximum limit, it will cause a decrease in efficiency. This means that the number of family members of Kamang cracker home industry business actors in a certain amount has an impact on the decision making of business actors

3.10 Management

The technical efficiency level of management variables. Management has a significant level of efficiency at 5% alpha with a value of 2.624, which means that Thit is higher than Ttab, so the management variable has a real effect on the technical efficiency of Kamang crackers. Management in the production process of Kamang crackers is the proportion of cracker sizes measuring 8 cm and 15 cm. This will certainly affect the time efficiency in the production process of Kamang crackers. If home industry businesses produce 8 cm Kamang crackers, the process will take quite a long time because the process of transferring Kamang crackers that have been printed to samia by manual process, namely moving one by one Kamang crackers that have been printed. If home industry businesses produce 15 cm Kamang crackers, it will be more time efficient.

4. CONCLUSIONS AND SUGGESTIONS

Based on the research results above, it can be concluded that the technical efficiency level of the Kamang cracker home industry ranges between 21% - 99% with an average technical efficiency level of 57.92%. This level shows that the Kamang cracker home industry is technically efficient but still needs to be increased by 83.25%. With an increase difference of 25.25%, it still needs to be improved further and the factors that influence technical efficiency in the Kamang cracker home industry are raw materials, salt supporting materials, labor, age, number of family members and management. Where the T-table value is greater than T-count so that this factor has a real influence on the technical efficiency of the Kamang cracker home industry. Meanwhile, the variables of supporting materials in the form of spring onions, fuel such as gas and pertalite, education and business experience do not have a significant effect on the Kamang cracker home industry.

Suggestions that researchers can give after conducting research as consideration for overcoming this problem are to increase technical efficiency in the Kamang cracker home industry, technology is needed in peeling cassava so that the contents of the cassava are not wasted in the peeling process, and improving the method of moving Kamang crackers to the drying place (samia). to be of better quality. In the packaging process, there are no Kamang crackers that need to be cut so they are the same size. The government should organize a cassava planting program by utilizing empty land to overcome the scarcity of raw materials.

REFERENCES

Andini, G.T., 2017. Analisis Tataniaga Kerupuk Kamang Dari Kenagarian Kamang Hilir Kecamatan Kamang Magek Kabupaten Agam. Skripsi Universitas Andalas, Padang.

Badan Pusat Statistik Sumatera Barat, 2021. Komudidas Unggulan Kabupaten Agam Tahun 2021.

Coelli, T., 1998. An Introduction to Efficiency and Productivity Analysis, Luwer Academic Publisher. Boston.

Darmawan, D.P., 2016. Pengukuran Efisiensi Produktif Menggunakan Pendekatan Stochastic Frontier. Elmatera, Denpasar.

Geivanni, T.A., 2017. Analisis Tataniaga Kerupuk Kamang Dari Kenagarian Kamang Hilir Kecamatan Kamang Magek Kabupaten Agam. Skripsi Universitas Andalas. Padang.

Lamusa, A., 2009. Risiko Usahatani Padi Sawah Rumah Tangga di Daerah Impenso Provinsi Sulawesi Tengah. Jurnal Agroland. 17, 226-232.

Maryanto, M.A., Sukiyono, K., Priyono, B.S., 2018. Analisis Efisiensi Teknis dan Faktor Penentunya Pada Usahatani Kentang (Solanumtuberosum L) di Kota Pagar Alam Provinsi Sumatera Selatan. Jurnal Agraris 4(1), 1-8.

Primalasari, I., Sukiyono, K., Romdhon, M.M., 2019. Techinical Efficiency of Skipjack Smoked Fish Processing Business in North Sulawesi Province and Its Determinant Factors. Jurnal Agric 31(1), 41-52.

Rahmi, N., 2014. Analisis Kegiatan Unit Pelayanan Pengembangan Pengolahan Hasil Pertanian (UP3HP) Kerupuk Ubi Kamang Mekar Rasa Di Kecamatan Kamang Magek Kabupaten Agam. Fakultas Pertanian. Universitas Andalas. Padang.

Sugiyono, 2016, Metode Penelitian Kuantitatif, Kualitatif dan R&D. PT Alfabet, Bandung.

Sugiyono, 2010. Metode Penelitian Pendidikan Pendekatan Kuantitatif, kualitatif, dan R&D. Bandung: Alfabeta.

Sukiyono, K., Romdhon, M.M., 2016. Assesing Technical Efficiency for Bengkulu Province Catching Fishery Industries and Determination of It's Technical Effeciency. International Journal of Fisheries and Aquatic Studies 4(6), 168-174.

Susanto, E., Ninuk. H., Nur, E.S., 2014. Respon Pertumbuhan dan Hasil Tanaman Ubi Jalar (Ipomoea batatas L.) Pada Beberapa Macam dan Waktu Aplikasi Bahan Organik. Jurnal Produksi Tanaman. 2 (5), 412-418.

Tajerin, T., Noor, M., 2005. Analisis Efisiensi Teknis Usaha Budidaya Pembesaran Ikan Kerapu Dalam Keramba Jaring Apung Diperairan Teluk Lampung : Produktivitas, Faktor-faktor yang

Mempengaruhi dan Implikasi Kebijakan Pengembangan Budidayanya. Jurnal Ekonomi Pembangunan 10(1), 95 – 105.

Thermolen, B., Herlin, L., Paturochman, M., 2016. Analisis Efisiensi Penggunaan Beberapa Faktor Produksi Usaha Itik Pedaging. Jurnal Ilmu Ternak 16(1), 18 – 22.

Tinaprilla, N., Kusnadi, Hakim., 2013. Analisis Efisiensi Teknis Usahatani Padi Di Jawa Barat Indonesia. Jurnal Agribisnis. 7(1), 15-34.

Triana, Lora, Faidil., 2017. Pengembangan Industry Kreatif Melalui Komersial Produk Unggulan Daerah (Studi Kasus Pada Kecamatan Kamang Magek Kabupaten Agam). Skripsi Universitas Andalas. Padang.

Ukpong, I.G., Idiong, I.C., 2013. Maximum Likelihood Estimates and Determinants of Technical Efficiency of Leafy Vegetable Producers in Akwa Ibom State, Nigeria. Journal of Agricultural Sciences 5(3), 139-145.

Wang H. J., Schmidt P, 2002. One-Step and Two-Step Estimation of the Effects of Exogenous Variables on Technical Efficiency Levels. Journal of Productivity Analysis. Kluwer Academic Publishers. Netherlands

Yoko, B., Syaukat, Y., Fariyanti, A., 2014. Analisis Efisiensi Usaha Tani Padi di Kabupaten Lampung Tengah. Journal of Indonesia Agribusiness Vol. 2 No. 2, 127-139.