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EXTENDED APPROACH OF LAND EXPECTATION VALUE (LEV) TO CAPTURE UNEARNED INCREASES IN LAND VALUES: MICRO-EMPIRICAL EVIDENCE ON SUBOPTIMAL LAND IN SOUTH SUMATRA, INDONESIA

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Abstract

Suboptimal land has a great potential for agriculture. However, regional development demands competition for agricultural land use is increasing; no exception suboptimal of swamp. This study aims to calculate the land rent of paddy fields. The calculations of land rent are carried out in 2-scenarios, namely: 1) real calculations, based on the production produced by farmers; and 2) ideal calculations, based on the production recommended by the Agricultural Service. Both land rents were calculated based on both Richardian and Von Thunen approaches. The research findings recommend for 1) the expected value of land; and 2) the level of farmers' welfare.

Keywords: land cover change; land expectation value; Richardian land rent; Von Thunen land rent; suboptimal land.

A. INTRODUCTION

Limited land resources lead to high demand, and a region's population and econ-omy cause competition in agriculture and non-agriculture use. This is consistent with countries such as Indonesia, which is experiencing an economic transformation from agricultural to industrial and service sectors. Infrastructure development increased demand for agricultural land, with no exception to the suboptimal rice fields of swamps. The rice field in South Sumatra currently reaches 739,395 hectares, consisting of 124,389 hectares of irrigated paddy fields, 92,792 hectares of rainfed land, 255,921 hectares of tidal land and 266,293 hectares of non-tidal swampland (Badan Pusat Statistik, 2020). Tidal land and non-tidal swampland are suboptimal lands that have great potential in agricultural development (Wildayana, 2017; Zahri et al., 2018; Parikesit et al., 2020).

The competition is increasingly asymmetrical when the value of agricultural land rents is lower than that of industry and housing(Arnoult et al., 2010) Thesis (Purbiyanti, 2013) mentioned several studies on the comparison of land rent assessment of rice fields to other uses, such as rice fields : industry = 1:500 (Iriadi, 1990), rice fields : tourism = 1:14 (Kartika, 1991), rice fields : production forests = 1:2.6 (Lubis, 1991), rice fields : housing = 1:622 (Riyani, 1992), rice fields : palawija = 1:1.7-4, rice fields : vegetables = 1:14-46.7, rice fields : ornamental plants = 1:904.2 (Sitorus et al. , 2007), and Rice fields : palm oil = 1:1.33 (Hamdan, 2011). This resulted in low bargaining power in agriculture, particularly food crops, compared to the

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non-agricultural sector. Land has a low rental value since its evaluation ignores all but one of its immediate advantages (Barlowe, 1978).

Based on the Regulation of the Director General of State Wealth No. 7/KN/2017 on Guidelines for the Implementation of State Property Assessment, the assessor of data should pay attention to a) physical factors, including location, type, area, shape, size, contour, elevation, general facilities, and ownership documents; b) non-physical factors, including economic, social, and government (Prasetyo and Loly, 2020). However, this assessment is not easy and has lower resources, hence the process of returning services and transactions is referred to as "compensation" instead of profit. A resource's valuation should consider the various benefits, but the calculation is uneasy and tends to use only financial analysis (Wahyunto, 2009; El-barmelgy et al., 2014). It does not use economic analysis, and the market price of the land reflects the accumulated present value of future revenue streams. This is known as land economy rent (Barlowe, 1978; Czyzewski and Matuszczak, 2016; Chu et al., 2019). An increase in agricultural production and rent value can positively affect land prices (Van den Berg et al., 2007; El-barmelgy et al., 2014). The farmers' minimal bargaining power on their land places them in the situation of getting prices that are virtually invariably detrimental. For farmers, land should be an important factor of production and a saleable item that can provide great benefits. Simple mathematical calculations should always precede the decision to make changes in use and land tenure. The potential accumulation of net income is referred to as the expected value of land (NHAL), an extension of the land expectation value (LEV) concept.

The LEV concept describes the potential accumulation of net income on land use. This includes a 1-cycle of cultivation, starting from the age of the 0^{th} crop (investment costs) to the n^{th} during the productive age of the plant (for perennial plants) and for several months (for rice crops). Meanwhile, the expected value of land (NHAL) describes the potential accumulation of net income for the remaining life of farmers' expectations, during the productive life of the plant. Therefore, the calculation of the value of expectations is considered more realistic. This study aims to analyze the calculation of the land value of farmers' expectations and measure the level of efficiency of rice farming. The results of the study are expected to be a guide for farmers regarding the minimum land price and also a picture of the level of farmer's welfare.

B. MATERIALS AND METHODS

This research was conducted in Arisan Buntal Village, Kayuagung District, Ogan Komering Ilir (OKI) Regency of South Sumatra Province-Indonesia (**Fig. 1**). The site selection was carried out deliberately, considering that this village was bypassed by the construction of a toll road that required farmers to convert their paddy fields for the national needs. This shows that invisibly there has been a change in land use from agricultural land to non-agricultural use. The required data consists of primary data and secondary data. Data collection was carried out in October 2019. The rice growing season in swampy rice fields is only 1 time per year. However, the planting and harvesting period varies depending on the condition of the pond. Usually start planting in April or May, and harvesting in August or September. Primary data consists of characteristics and farming that sample farmers strive for. Secondary data, such as village

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profile, district expectation age, and general inflation rate, are collected from various relevant agencies and official websites. Determination of the number of samples used in this study using the the Slovin formula (Yang, Lin and Hu, 2020; Gomes et al., 2022):

$$n = \frac{N}{N \cdot d^2 + 1}$$

Which: n = total sample; N = total population; d^2 = desired percentage (in this research we determined 10% of the total population. The total number of farmers are 124 of farmer households, whose rice fields are passed by the construction of toll roads. So, the formula to calculate the number of samples used in this research is as follows:

$$n = \frac{124}{124 \cdot (0.1)^2 + 1} = 55.35 \approx 55$$

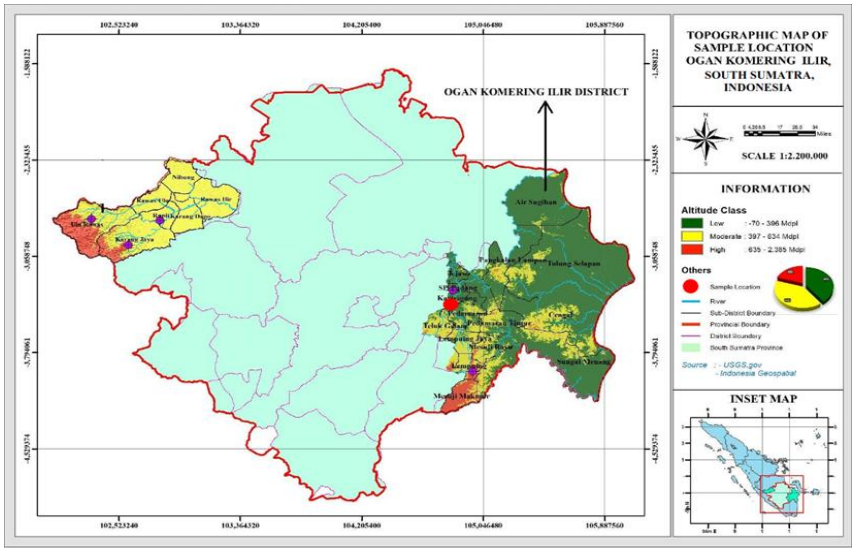

Figure 1: Location of research

To measure in detail how many paddies field has changed its use into toll roads especially, this study is also supported by GIS data processing. This is projected from changes in vegetation that are not dense in the composition of land cover analysed using GIS (geographic information system) Landsat 7 Satellite Imagery for 1996 and 2010 and Landsat 8 for 2020. The scale used is 1:40,000, and the composition of the land cover analysed consists of dense vegetation (forest), non-dense vegetation (open area/paddy fields), rivers, settlements, and toll roads. These data on the change in agricultural land use to non-agricultural use illustrate that the demand for agricultural land is very unstoppable as a logical consequence of the regional development (Purbiyanti et al., 2019). Meanwhile, this NHAL data is important to provide an overview of the potential minimum land price if farmers are faced with the choice of continuing to farm or sell their paddy field.

This study aims to calculate the land rent of paddy fields. The calculations of land rent are carried out in 2-scenarios, namely: 1) real calculations (as NHAL-R_1 and NHAL-V_1), based on

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the production produced by farmers; and 2) ideal calculations (as NHAL-R_2 and NHAL-V_2), based on the production recommended by the Agricultural Service. Both land rent calculations were calculated based on Richardian and Von Thunen approaches. NHAL is an accumulation of the current value of the net income of swamp rice farming businesses. It serves as a lower limit of land market prices used as a benchmark when selling their land. Or in other words, this NHAL calculation is a financial calculation based on direct value (Gomes et al., 2022); has not taken into account other benefits of land resources, such as: the function values, the options values, the bequest values, and existence values (Boratyńska and Huseynov, 2017; Mira, Saptanto and Hikmah, 2017; Roslinda, 2019). The remaining value is obtained from the reduction between the life expectancy of the district for t period minus the farmer's age. The use of district life expectancy data is the first novelty in this study, assuming farmers continue to farm for the duration of their productive life. The remaining life expectancy of farmers calculated by this formula:

$$\textbf{The remaining of the farmer's life expectancy} = \textbf{the district's life expectancy} - \textbf{the age of the farmer}$$

As for the calculation of NHAL (P_t^h) in the year t is formulated as follows (Randall, 1987):

$$\mathbf{P_t^h} = \sum_{\tau=i+1}^{\infty} \frac{\mathbf{p_\tau^h}}{(\mathbf{1}+\boldsymbol{\tau})^{\boldsymbol{\tau}}}$$

Where:

$\mathbf{P_t^h}$	=	Value of expectations on land = market price of land.
$\mathbf{p_\tau^h}$	=	Present net income during the remaining period of the farmer's expected life for the τ^{th} period.

The Expectations on land rent in Ricardian and Von Thunen approaches (then abbreviated as NHAL-R and NHAL-V) are calculated based on the accumulated value of gross and net income over the average of remaining of the farmer's expected life. In other words, NHAL-R is an accumulation of real Gross Income for the rest of the productive life added to the real value of the current year (year 0) without considering the assumption of transportation costs. This is because the output of production is sold in the village. Meanwhile, NHAL-V is an accumulation of present net income for the rest of the productive life added to the current year's value (year 0), considering the assumption of transportation costs. This is because the products are sold in the subdistrict market, about 5 km from the village, assuming transportation costs of Rp100.00 each kilogram of output. The gross income value (named as NPdK) is the revenue minus the production costs; while the net income value (named as NPdB) is the revenue minus the production costs and also transportation ones. The accumulated values have been made real by multiplying them with discounting factor. Furthermore, the discounting factor of 4.86% per year is the average inflation rate in South Sumatra Province during the period 2010-2019.

The analysis of paddy farming is calculated based on the real production obtained by farmers, then compared with the potential based on the recommendations of the Research and Development Center of the Ministry of Agriculture. The paddy varieties used by farmers in the field are the same as recommended by the Ministry of Agriculture for swamp rice fields,

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namely: the flagship variety Inpara-4 with an average productivity of up to 8 tons/ha (Suparwoto, Waluyo and Sasmita, 2018). The Inpara-4 variety is an introduced variety from IRRI that has a bath tolerant gene. This gene allows plants to survive being submerged for 1-2 weeks in the vegetative phase. Inpara-4 (swamp rice inbrida) is a soak/swamp tolerant rice variety that has been released since 2010 by the Agricultural Research and Development Agency. The analysis of the Inpara-4 rice farming refers to the research results (Suparwoto and Waluyo, 2019) which are adjusted to the applicable discount factor.

The efficiency of using rice production inputs that will be measured in this study is price efficiency or allocative efficiency. It is said to be efficient if the value of the marginal product is equal to the price of its input/production factor (Soekartawi, 2010; Ningsih, 2017; Hastuti et al., 2022). In general, the model of the Cobb-Douglas type production function is as follows:

$$\mathbf{Y = AX^b}$$

Or,

$$\mathbf{\log Y = \log A + b \log X}$$

Thus, the conditions of marginal products are:

$$\mathbf{\frac{\partial Y}{\partial X} = b}$$

In the Cobb-Douglas function, b is called the regression coefficient which also describes the elasticity of production. Thus, then the marginal product value (NPM) of production factor X, can be written as follows:

$$\mathbf{NPM = \frac{b.Y.P_y}{X}}$$

Where:

b	=	Elasticity of production.
Y	=	Production.
P_x	=	Production price.
X	=	Number of production factors X.

Price (allocative) efficient condition if NPM_x is equal to the price of production factor X, or can be written as follows (Soekartawi, 2010):

$$\mathbf{\frac{b.Y.P_y}{X} = P_x}$$

Or,

$$\mathbf{\frac{b.Y.P_y}{X.P_x} = 1}$$

Where:

P_x	=	The price of the production factor X and other symbols is the same as in the previous caption.

The above conditions are often not encountered, because: a) farmers' knowledge in using production factors is limited; b) farmers' difficulty in obtaining production factors in timely quantities; and c) the presence of external factors that cause farmers not to try to farm efficiently. Therefore, it is likely that the following conditions will be encountered:

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$\frac{b.Y.P_y}{X.P_x} > 1$	=	Can be interpreted that the use of the production factor X is considered **inefficient**.
$\frac{b.Y.P_y}{X.P_x} < 1$	=	Can be interpreted that the use of the production factor X is considered **not yet efficient**.

C. RESULTS AND DISCUSSION

In 2014, the government officially assigned Hutama Karya to develop the Trans Sumatera Toll Road. Through Presidential Regulation (Perpres) No. 100 of 2014, which was later amended by Presidential Regulation No. 117 of 2015, the Government gave a mandate to Hutama Karya to develop 2,770 kilometers of Trans Sumatera Toll Road with 8 sections as the first priority (www.hutamakarya.com). Trans Sumatra Toll Road consists of 15 main and 9 supporting corridors, totalling 2,704 km stretching from Aceh to Lampung (Admin, 2020). In contrast, the construction of the Kapal-Betung toll road is part of the main corridor of the Trans Sumatra Toll Road, whose development is conducted by Toll Road Business Entity of PT. Waskita Sriwijaya Tol (WST). PT. WST built the Kapal-Betung toll road with 111.69 km and a concession period of 50 years starting in 2016.

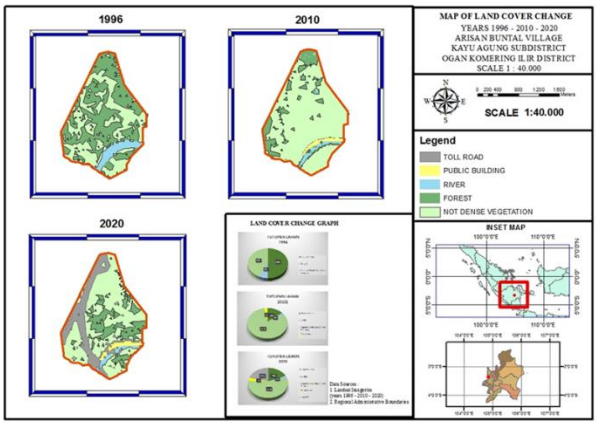

Figure 2. Extent of land cover changes for period 1996-2020

Based on the **Fig. 2** above, there has been a change in land cover in the composition of dense (forest) and non-dense vegetation (open area, including rice fields), rivers, settlements, and toll roads. Dense vegetation decreased significantly from 1996 to 2010 due to the many openings of private plantation areas in the OKI District. As of 2017, there were 56 concessionaire companies [20] since its initial opening in 1988, with a concession permit area of 549,689.87 ha[1]. Non-dense vegetation (open acreage) increased in 2010 compared to 1996 but nosedived the reduction in 2020, with 66.1 ha. This is followed by the existence of a 53.3 ha toll road on the 2020 map that previously did not exist. Therefore, there has been a reduction in the wetland area of 66.1 ha, followed by an increase in settlements and toll roads covering an area of 1.7 ha and 53.3 ha. Forests also increased by 11.1 ha due to the growth of plantation land, whose title has been increasingly docked. **Table 1** summarizes the changes in land cover in Arisan Buntal Village for period 1996-2020.

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Table 1. Land Use and Land Cover (LULC) Changes and Statistics for Period 1996-2020

LULC Type	1996		2010		2020	
	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
- Forest	127.20	50.2	35.70	14.1	46.80	18.5
- Not dense vegetation (wetland)	110.60	6.2	205.10	2.4	139.00	2.4
- Public building	0.00	43.6	6.40	81.0	8.10	54.9
- River	15.70	0.0	6.10	2.5	6.10	3.2
- Toll road	0.00	0.0	0.00	0.0	53.30	21.0
Total	253.50	100.0	253.30	100.0	253.30	100.0

Source: GIS data results, 2021.

The construction of the Kapal-Betung toll road that crosses Arisan Buntal Village has reduced the area of existing rice fields. Based on the results of the GIS (geographic information system) analysis of land cover in 1996, 2010, and 2020, there has been a change in the composition proportion (**Fig. 3**). Arisan Buntal village has an area of 268 hectares, and the topographical condition is a lowland with a height of ± 10-20 meters above sea level. The Batanghari River feeds Arisan Buntal village, which connects the Komering Ulu area to the Musi River, with a population of 1,963 people. The female population is more dominant, and the transportation supporting economic activities in Arisan Buntal Village uses land and river routes. Transportation facilities have been passed by public transportation, such as the Damri bus. Most of the population travel using their vehicles, such as motorcycles and cars.

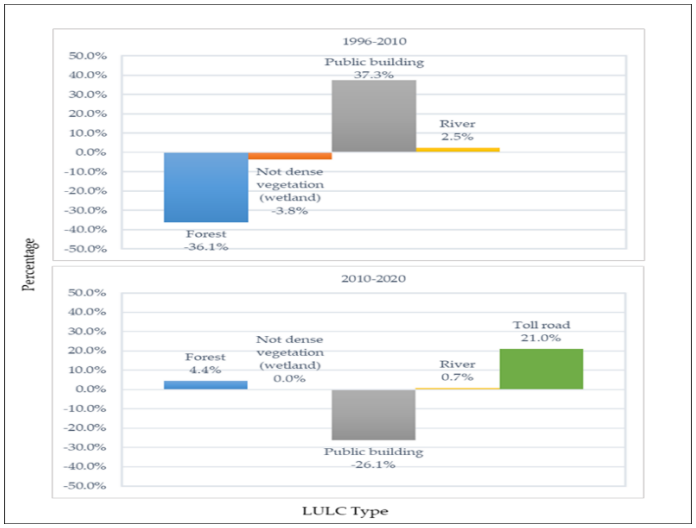

Figure 3. Land use and land cover changes for period 1996-2020

Considering the features of the farmers' characteristics (**Fig. 4**) explain the following. The largest percentage at 53% is at the age of 40-59 when viewed from age. Regarding education, 58% are only educated in elementary school, while 3% are highly educated. The largest number of family dependents at 47% is 4-5 people per head of the family. Regarding arable land area,

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60% have an area of <1 hectare, which manages >3 hectares of 10% farmers. Based on the data below, swamp rice farmers are at a productive age and have sufficient labour potential in the family with limited education and an area of arable land. This condition causes farmers to experience material and non-material capital, including difficulty accessing funds. Therefore, it is necessary to increase skills and mentoring activities for farmers.

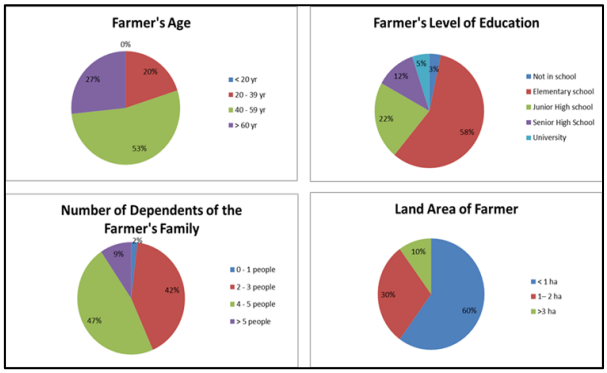

Figure 4. Characteristics of farmers.

The reduction of open acreage (rice fields) has implications for the farming of swamp rice farmers. The livelihood of the population in Arisan Buntal Village is 75% swamp rice farmers, 5% residents who work in the plantation field, 5% working in fisheries, and 25% scattered outside agriculture, such as traders, craftsmen of the household industry, Civil Servants, laborers, and other occupations. In addition, farmers have side jobs to increase family income (**Fig. 5**) because the swamp rice farming business is only conducted once in a growing season. The income of swamp rice farming businesses has demanded the generation of other additional income. Most farmers still expect additional family income from natural wealth, such as installing fishing net cages, sucking river sand, becoming laborers in plantation companies around the village, or selling groceries at home stalls.

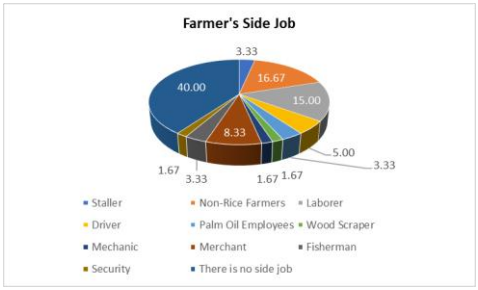

Figure 5. Percentage of farmers based on their side-jobs.

Based on the figure above, the largest percentage, at 40%, consists of farmers who do not have side jobs. This condition is very dilemmatic due to the lack of capital to increase income. Compared to other additional jobs, 16.67% of farmers conduct non-rice side farming relatively more. Farmers try farming horticulture to be sufficient for their food needs, such as Bawang Prei (Allium ampeloparsum var. Porrum), Gambas (Luffa acutangula), Bayam (Amaranthus

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hybridus), Kacang Panjang (Vigna sinensis), Timun (Cucumis sativus), Tomat (Solanum lycopersicum), Ubi (Pastinaca sativa), etc. The reduction of rice fields has negatively affected the local economy and resulted in floods and inundation of some land (Purbiyanti et al., 2019). Farmers experienced crop failure and even failed to plant due to the flood. They switch jobs as farmworkers in local plantation companies, transport workers in the market, or migrate temporarily to work as laborers in the city. After completing nursery and planting, some still attempt to establish usable rice fields due to temporary migration.

The expected real land value based on rice farming carried out by farmers is still lower than the potential value (**Table 2**). This can be seen from NHAL-R_1 only 61.15% against NHAL-R_2 and NHAL-V_1 which is only 60.98% against NHAL-V_2. Therefore, this real condition should be improved in order to achieve its potential. The rice farming business carried out by farmers in the last 7-years is indeed less than optimal because the rice fields are always flooded.

Table 2. Mean and Standard Deviation Value of Swamp Rice Farming

No.	Items	Mean	Standard Deviation
1.	Average Respondent		
	Production (kg/acre)	6.125.71	3,571.57
	Acreage (ha)	0.96	1.48
	Fertilizer (Rp/kg/acre)	447,571.98	780,603.22
	Pesticides (Rp/L/acre)	341,559.63	477,680.66
	Labour (Rp/days/acre)	1,401,892.99	1,583,556.83
	Age of the plant (yr.)	0.33	0.00
2.	Average per hectare		
	Productivity (kg/ha)	6.376.95	7,614.32
	Fertilizer (kg/ha)	466,220.81	877,082.27
	Pesticides (L/ha)	355,791.28	536,719.84
	Labour (Rp/ha)	1,460,305.10	1,779,277.34
3.	Average price		
	Production (Rp/kg)	4,856.90	0.00
	Fertilizer (Rp/kg)	2,000.00	0.00
	Pesticides (Rp/L)	8,000.00	0.00
	Labour (Rp/days)	50,000.00	0.00
4.	Gross income of paddy farming at 0^{th} year (Rp/yr.)	22,316,009.67	
	Potential gross income of paddy farming at 0^{th} year (Rp/yr.)	30,969,519.95	
	Assuming: Transportation cost per product (Rp/kg)	100.00	
5.	Net income of paddy farming at 0^{th} year (Rp/yr.)	21,678,314.66	
	Potential gross income of paddy farming at 0^{th} year (Rp/yr.)	30,169,519.95	
	Remaining of farmer's age (yrs.)	17.89 ≈18.00	
6.	NHAL-R_1 for 19 years (Rp/ha)	242,749,724.98	
	NHAL-V_1 for 19 years (Rp/ha)	235,811,322.01	
	NHAL-R_2 for 19 years (Rp/ha)	396,982,982.85	
	NHAL-V_2 for 19 years (Rp/ha)	386,728,177.91	

Where:

$NHAL - R_1$	=	The real expected value of land, based on Richardian approached.
$NHAL - V_1$	=	The real expected value of land, based on Von Thunen approached.
$NHAL - R_2$	=	The potential expected value of land, based on Richardian approached.
$NHAL - V_2$	=	The potential expected value of land, based on Von Thunen approached.

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Besides this field has not been produced optimally for the last 7-years, low NHAL value due to the use of production factors that are not and have not been efficient yet (**Table 3**). The use of land production factor is considered inefficient. This is because the existing paddy fields are flooded. A lot of redundant land causes the use of it to be inefficient. Meanwhile, the use of others production factors, namely: seeds, pesticides, NPK fertilizers, and labour are not efficient yet. The use of production factors by scattering methods, such as the habits of local farmers on stagnant land, causes seeds, fertilizers, and pesticides to be washed away. Inefficient use of production factors causes the production and income of farmers to be not optimal, More-over, only 1 production in a year. This illustrates the inadequate level of welfare of farmers.

Table 3. Ratio of HFP and NPM on Swamp Rice Farming

Factors of Production	HFP_x	Swamp Rice Farming		Conclusion	Interpretation
		NPM_x	NPM_x/HFP_x Ratio		
Land (ha)	100,000,000.00	18,173,184.73	0.18	<1	Inefficient
Seed (kg)	5,900.00	-59,600.67	10.10	>1	Not Efficient yet
Pesticides (L)	8,000.00	496,706.25	62.09	>1	Not Efficient yet
NPK Fertilizer (L)	2,000.00	18,284.72	9.14	>1	Not Efficient yet
Labour (days)	50,000.00	79,975.12	1.59	>1	Not Efficient yet

Source: primary data processed, 2021

Where:

HFP_X	=	The price of X production factor.
NPM_X	=	The marginal product value of X production factor.

In addition to the factor of flooded land over the past 7-years, the use of production factors that have not been or inefficiently is caused by several conditions, such as: farmers' knowledge in using production factors is limited, farmers' difficulty in obtaining production factors in timely quantities, and the presence of external factors that cause farmers not to farm efficiently (Soekartawi, 2010). The level of education of farmers, the majority of whom only graduated from elementary school and also the lack of agricultural extension workers, caused limited knowledge of farmers in the use of production factors. Inadequate infrastructure constraints and minimal capital cause farmers to find it difficult to get production factors in a timely and precise amount. Natural factors and climate change are also aggravating existing conditions.

This then causes the net value of land rent which describes the expected value of land is not optimal. Moreover, in its calculations, this NHAL also does not calculate other return values (land rent), such as plantation plants in rice fields. Therefore, the return value (land rent) of the land cultivated for paddy farming is always lower than the return value (land rent) on the land for non-agricultural use. This expected value of land is a guideline for the minimum price of farmers' land. Of course, this price still needs to be added with non-physical factors, such as: job loss, change of job, emotional loss and loss due to the rest of land and other conditions.

The geographical conditions are suitable for developing a village based on agriculture and trade. Therefore, the Ogan Komering Ilir Regional Government is expected to conduct training

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and assistance to the farmers to be more independent and competitive through productive and value-added activities; both in farming and others. The local governments also need to develop the farmer' institutions to strengthen the bargaining position of farmers; including facilitating farmers by providing a definite market for their value-added productions. Thus, through optimization in farming and production outside of value-added farming will increase the farmer's households' income and the regional economy will develop and advance rapidly.

D. CONCLUSIONS AND RECOMMENDATIONS

Compared to 2010, there was a reduction and increment in the open and settlement areas by 32.23% and 26.56% in 2020. The existence of toll roads utilizes 21.04% of the entire village area. This shows that the demand for paddy fields to be converted into non-agricultural use is increasing along with the development of an area. The expected value of land is the value of returns on land use which is calculated based on 1 type of farming. The results of the calculations of NHAL Richardian and Von Thunen concluded that the distance of the land location to the market center (which is proxied from the transportation cost per unit product) greatly influenced the amount of NHAL obtained; the farther away from the market center, the lower the NHAL will be. The use of production factors in rice farming has not been efficient, so it must be improved so that optimal conditions are achieved and the level of farmer welfare can be realized. This NHAL calculation serves as a guide for farmers in assessing the minimum price of their land if faced with various choices in land use. Based on NHAL Richardian's calculations, the sales of rice produced should only be around the village, considering that rice is the main food ingredient that everyone needs. However, the calculation of NHAL Von Thunen can still be recommended if farmers make efforts to add value to the rice produced. For example, by producing organic rice whose selling price is much higher for consumers in urban areas who need organic rice more for health reasons. The participation of local governments is very necessary to strengthen the bargaining position of farmers through institutions and assistance to produce products that have added value, both in the upstream and downstream sectors. Improving the welfare of farmer households will also support a significant increase in the regional economy.

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