ISSN : 1412-8837
e-ISSN : 2579-9959
JURNAL AGRISEP
Kajian Masalah Sosial Ekonomi Pertanian dan Agribisnis
DOI: 10.31186/jagrisep.22.2.343-362

IMPACT OF IRRIGATION DEVELOPMENT ON SOCIO-ECONOMY AND REGIONAL DEVELOPMENT (CASE STUDY IN THE WAY TULUNG BUHO IRRIGATION AREA, TIYUH KIBANG YEKTI JAYA, LAMBU KIBANG DISTRICT, WEST TULANG BAWANG REGENCY)

Dampak Pembangunan Irigasi terhadap Sosial Ekonomi dan Pengembangan Wilayah (Kasus di Daerah Irigasi Way Tulung Buho Tiyuh Kibang Yekti Jaya Kecamatan Lambu Kibang, Kabupaten Tulang Bawang Barat)

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ABSTRACT

Agricultural development aims to increase rice production to meet the food needs of the population. The development of irrigation networks is one of the efforts to increase rice production and create new rice fields carried out by the government, one of which is the Development of the Way Tulung Buho Irrigation Area, Tiyuh Kibang Yekti Jaya, Lambu Kibang District, West Tulang Bawang Regency. This study aims to examine the effect of irrigation development on agricultural, social and economic productivity, as well as the feasibility of irrigation development and development. This research was conducted by collecting data from all farmers who received Way Tulung Buho irrigation services in Tiyuh Kibang Yekti. The results showed that irrigation development had a positive and significant impact on increasing rice production, increasing the cropping index and being able to create new rice fields. The socio-economic impacts are in the form of the establishment of P3A organizations, increasing farmers' income and flooding problems that occur when irrigation is operating. Irrigation development is economically feasible and irrigation area development plans can be implemented.

Keyword:* *agricultural productivity, economic feasibility, irrigation, social economy, regional development

ABSTRAK

Pembangunan pertanian antara lain bertujuan untuk meningkatkan produksi beras guna memenuhi kebutuhan pangan penduduk. Pembangunan jaringan irigasi adalah salah satu upaya untuk meningkatkan produksi padi dan mencetak sawah baru yang dilakukan oleh pemerintah, salah satu diantaranya adalah Pembangunan Daerah Irigasi Way Tulung Buho, Tiyuh Kibang Yekti Jaya, Kecamatan Lambu Kibang, Kabupaten Tulang Bawang Barat. Penelitian ini bertujuan untuk mengkaji pengaruh pembangunan irigasi terhadap produktvitas pertanian, sosial dan ekonomi, serta kelayakan pembangunan dan pengembangan irigasi. Penelitian ini dilakukan dengan mengambil data dari seluruh petani yang mendapat layanan irigasi Way Tulung Buho di Tiyuh Kibang Yekti. Hasil penelitian menunjukan bahwa pembangunan irigasi berdampak positif dan signifikan terhadap peningkatan produksi padi, meningkatkan indeks pertanaman serta dapat mencetak sawah baru. Dampak sosial ekonomi berupa terbentuknya kelembagaan P3A, peningkatan pendapatan petani dan masalah banjir yang terjadi saat irigasi beroperasi. Pembangunan irigasi layak secara ekonomi dan rencana pengembangan daerah irigasi dapat dilaksanakan.

Kata kunci: produktivitas pertanian, kelayakan ekonomi, irigasi, sosial ekonomi, pengembangan wilayah

INTRODUCTION

Indonesia is a developing country that has several sectors to support the economy, one of the most important is Agriculture. One of the potential natural resources that can support agricultural and regional development is water resources. Water is a natural resource that is needed by humans at all times and is a very important part of basic human needs (Kodoatie & Sugiyanto, 2002). Water is needed by every living thing to survive and carry out daily activities (Harahap et al., 2023). One of the uses of water resources to meet food needs is its use in irrigation systems.

The development of irrigation networks to support the provision of national food is urgently needed. So far, the contribution of irrigation infrastructure and facilities to food security is quite large, namely as much as 84 percent of national rice production comes from irrigation areas (Hasan, 2005). This is inseparable from the business of irrigation techniques, namely providing water with the right quality, right space and right time in an effective and economical way (Sudjawardi, 1990).

Efforts to increase agricultural production (rice) have been carried out by the government, non-governmental organizations and universities (Astuti & Wibawa, 2014). One of the activities to achieve the food improvement program is through agricultural extensification by opening agricultural land in the form of creating new rice fields (Azhari et al., 2017). The development and existence of irrigation networks to increase the productivity of food crops, especially paddy rice. The farther agricultural land is from irrigation, the greater the possibility of neglect of agricultural land (Samad & Hermadi, 2022).

Indonesia has a total irrigation area of around 7.2 million Ha, which contributes 84% to national rice production, the remaining 16% is contributed by swamp rice fields of 0.49 million ha, groundwater irrigation networks of 0.09 million ha, and others (rainfed rice fields and village irrigation) 1.4 million Ha (Febriani & Putra, 2022). One of the areas that has a fairly large area of rice fields is Lampung Province. The area of paddy fields owned by Lampung Province reaches 490,588.98 Ha with a productivity of 5.94 tons/Ha (classified as good). The number of rice fields in Lampung Province in one year (2020 to 2021) has decreased drastically. It was recorded that the land owned by Lampung Province in 2020 was 545,149.05 Ha, which meant that it had decreased by 54,593 Ha (BPS Provinsi Lampung, 2022).

West Tulang Bawang Regency is one of the regencies in Lampung Province which has experienced an increase in harvested area from 6,360.79 Ha to 6,994.69 Ha (an addition of 63.8 Ha) in 2022 with a productivity of 4,833 tons/hectar (BPS Tulang Bawang Barat, 2022). This positive result shows the success of the agricultural land extensification and intensification program in West Tulang Bawang Regency which was carried out through the construction of new irrigation networks, one of which is the construction of the Way Tulung Buho Irrigation, Lambu Kibang District in 2021.

The Way Tulung Buho Irrigation Network was built with concrete channel with a length of 1,240 meters and a planned area of 40 Ha and has a development plan in 2023 to 2024. The construction of this irrigation allows rural communities whose rice fields are rainfed rice fields with one to two planting seasons per year to change into irrigated rice fields with an increase in planting seasons to two or three times a year. In addition, this irrigation development also encourages local people to change the function of their land from rubber and cassava plantations to rice plants because irrigation development is planned on rubber and cassava plantation land area of 34.50 Ha and an area of 5.50 Ha in rainfed paddy fields.

Therefore, research is needed regarding the Impact of Way Tulung Buho Irrigation Network Development on Socio-Economic Conditions and Regional Development in Tiyuh Kibang Yekti Jaya, Lambu Kibang District, Tulang Bawang Regency to determine the effect of irrigation development on agricultural productivity, socio-economic conditions, and the feasibility of development towards area expansion. The economic feasibility benefits are estimated from the efficiency of water use and the gains compared to the costs involved in constructing and treating the water infrastructure (Rodríguez et al., 2020). Regional development aims to increase regional competitiveness, increase economic growth, reduce disparities between regions, and advance people's lives (Mutmaidah, 2018). The development of the Way Tulung Buho

Irrigation Network is expected to increase agricultural activities which will increase farmers' income as well as competitiveness, economic growth, and reduce disparities in Tiyuh Kibang Yekti Jaya and its surroundings.

This study aims to examine the impact of the construction of the Way Tulung Buho Irrigation Network on increasing agricultural production, analyze the effect of the construction of the Way Tulung Buho Irrigation Network on the socio-economic, and examine the feasibility of irrigation construction and development pan.

This research is expected to be able to solve problems that exist in irrigation areas, namely land plans for irrigation areas that have not been fully realized. It is hoped that the research results can be used as a consideration in finding solutions for farmers, village officials, the West Tulang Bawang Regency Government and related parties to optimize land realization in the Way Tulung Buho Irrigation Area. According to the 2011 – 2031 West Tulang Bawang Regency Spatial and Regional Plan land use map, the land around the Way Tulung Buho Irrigation Area has similar conditions. This research can be used as a reference by the West Tulang Bawang Regency Government to develop a long-term plan for the area around the Way Tulung Buho Irrigation Area.

This research is limited to the Way Tulung Buho Irrigation Area. Data on agricultural production and productivity as well as socio-economic conditions used are data from the Way Tulung Buho Irrigation Area before and after irrigation construction. Costs and income represent all investment costs, farming costs and farming income before and after the construction of the Way Tulung Buho Irrigation at prices prevailing in the field in March 2023.

RESEARCH METHOD

Study Area

The Way Tulung Buho Irrigation Area is located in Tiyuh Kibang Yekti Jaya, Lambu Kibang District, West Tulang Bawang Regency. The Way Tulung Buho Irrigation Area is an irrigation area that was built in April 2021 and completed in October 2021 with an allotted area of 40 Ha. The Irrigation Network consists of a 1,240 m long concrete irrigation channel. The Way Tulung Buho irrigation area takes irrigation water from the Way Tulung Buho River which divides the area of Tiyuh Kibang Yekti Jaya.

The area of paddy fields after the construction of irrigation has not been fully realized, while the land that has been realized is in the form of rice fields with three planting seasons per year covering an area of 9.50 Ha and rice fields with two planting seasons covering an area of 8.75 Ha. There are 8.50 Ha of cassava land and 21.45 Ha of rubber land which have not been converted into irrigated paddy fields. Besides that, there was also the addition of 8.75 Ha of new land which was changed from cassava to rice. If the land potential is fully realized, it will increase the area of 48.2 Ha of irrigated paddy fields, which means that land realization can exceed the previous plan, namely 40 ha of planned land and an additional 8.8 Ha of additional land outside the planned land (previously cassava and rubber land).

Data Collection

Data collection was carried out in February - April 2023 for all farmers who received irrigation services, namely 26 farmers who before the construction of irrigation had different crop commodities (Table 1.). The data collection used qualitative and quantitative methods through in-depth interviews (Creswell, 2012). The number of data from farmers who are respondents is determined by the total number of farmers who receive irrigation water in the Way Tulung Buho Irrigation Area, where the total number of farmers is 26 people.

Secondary data such as irrigation development project data, farmer data, and maps were obtained from the West Tulang Bawang Regency Government. Furthermore, the data is processed using predetermined methods such as the mean difference test method and the feasibility analysis method (NPV, IRR and BCR) in order to obtain results in accordance with the research objectives.

Table 1. Population and Sample Characteristics of Way Tulung Buho Farmers

No	Description	Plant				n	Area (Ha)	Average Area (Ha)
		Before	Season	After	Season			
1	Paddy - Paddy	Paddy	2	Paddy	3	8	5.50	0.69
2	Rubber - Paddy	Rubber	-	Paddy	3	4	4.00	1.00
3	Cassava - Paddy	Cassava	-	Paddy	2	12	8.75	0.63
	Total					26	18.25	0.77

Source : Results of Data Processing (2023)

Data Analysis

Analysis of the Average Difference Test to analyze the significance of differences in rice productivity and farmer income to support the first and second goals. The economic feasibility analysis of the investment is carried out to answer the third objective. Document studies of related documents were also carried out to support data analysis. Document studies are a complement to the use of observation and interview methods in qualitative research, even the credibility of qualitative research results will be higher if they involve/use document studies in their qualitative research methods (Nilamsari, 2014).

The first step of the research began with a field survey of all farmers who received irrigation water and collecting supporting documents. After all the data is obtained, the data is processed into several data to be used for data analysis. The results of data processing in the form of agricultural production and productivity data obtained from interviews were then analyzed using the mean difference test method to answer the first objective. The next step is processing data from farmer interviews and document studies to obtain the socio-economic conditions of farmers which will answer the second research objective. The final step is a project feasibility analysis using cost and income data in the Way Tulung Buho Irrigation Area.

Mean Difference Test

To answer the first and second objectives, namely the impact of irrigation area development on increasing agricultural production as well as social and economic conditions. This study used a one sample t test taken from farmer data before and after irrigation development. The condition is that the data is quantitative and has a normal distribution. One sample test in principle wants to test whether a certain value used as a comparison is significantly different or not from the average of a sample (Hermansah, 2017). The average difference test is carried out by the formula:

$$t = \frac{\bar{Y}_a - \bar{Y}_b}{\sqrt{s^2 \frac{1}{n_1} + \frac{1}{n_2}}}$$

where:

$\bar{Y}_a$ = Average production/income of rice with irrigation.
$\bar{Y}_b$ = Average production/income of rice without irrigation.
s^2 = Combined variant
n = Number of samples

Financial Feasibility Analysis

To answer the third objective, namely the feasibility of developing irrigation areas is carried out with project feasibility parameters. The benefits (benefits) of the construction of irrigation networks are not obtained directly by the government, but are obtained from the benefits received by the community (public) which are calculated based on the difference in rice production between before and after the construction of irrigation. Meanwhile, the cost used is based on the investment value of the development project as well as the operating and maintenance costs over the life of the investment (Lubis, 2011). In the feasibility analysis there are criteria that must be met, including: Net B/C Ratio, NVP, and IRR (Wahyuni et al., 2012).

a. Net Present Value (NPV)

NPV is the project's ability to obtain benefits per year. The Net Present Value (NPV) method is a method that is carried out by comparing the present value of net cash inflows (proceeds) with the present value of outlays. Therefore, to calculate the feasibility of an investment using the NPV method, data on initial cash outflows, future net cash inflows, and the desired minimum rate of return are required (Giatman, 2017).

$$NVP = \left\{ \sum_{t=1}^{t=\pi} \frac{Bt - Ct}{(1+i)^t} \right\}$$

Where:
Bt = Year i benefits
Ct = Cost of year i
i = Interest rate
t = Project age in year t

A project can be said to be feasible if the NPV is positive (NPV>0). If the NPV is negative (NPV<0) then the project is said to be not feasible and if the NPV is equal to 0 then the project is in break even point condition (Arjunan, 2019).

b. Internal Rate of Return

The Internal Rate of Return is the discount rate that makes the PV cash value of spending the same as the PV cash value of receipts (benefits). The information generated in this IRR method is related to the level of ability of cash flow to return investment capital which is described in the form of a percentage (%) of the time period and how much the obligation must be fulfilled. This ability is called the Internal Rate of Return (IRR), while the obligation is called the Minimum Attractive of Return (MARR) (Giatman, 2017).

$$IRR = DfP + \left\{ \frac{(PVP)}{(PVP)-(PVN)} \times (DfN - DfP) \right\}$$

Where:
DfP = Discounting Factor used, which produces a positive present value
DfN = Discounting Factor used, which produces a negative present value
PVP = Present Value is positive, meaning the area is developing
PVN = Negative Present Value means the area is not developing

In IRR analysis, a project is said to be feasible if the IRR value is greater than the factor discount value, if the IRR value is smaller than the factor discount value then the project is not feasible or can be rejected (Arjunan, 2019).

The discount factor used in this study is a social discount of 12% according to references from the Asian Development Bank journal. The current development project practice of applying a uniform social discount rate of 10 –

12% for all development projects in all countries in the world is still changing (developing) (Zhuang et al., 2007).

c. Benefit Cost Ratio (BCR)

This Benefit Cost Ratio method emphasizes the comparative value between the aspects of the benefits that will be obtained with aspects of the costs and losses that will be borne (cost) with the investment. Benefit Cost Ratio can be calculated by the formula:

$$B/C == \frac{\sum_{t=1}^{t=n} \frac{Bt}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{Ct}{(1+i)^t}}$$

Where:

Bt = Year i benefits
Ct = Cost of year i
i = Interest rate
t = Project life in years

A feasible project is a project that has a BCR value of more than one (BCR>1). A project that has a BCR value equal to one indicates that the project is in break even point condition. If the BCR value is less than one (BCR<1) then the project is categorized as not feasible (Giatman, 2017).

RESULT AND DISCUSSION

The research was conducted in the Way Tulung Buho Irrigation Area which will be built in 2021. The analysis was carried out based on interview data from all 26 farmers whose land is served by irrigation water. Based on the results of farmer interviews, the average age of farmers is 45.77 years with an average farming experience of 27.53 years. A total of seven farmers graduated from elementary school, 10 farmers graduated from junior high school and nine studied at high school level.

The average land area owned by farmers in the Way Tulung Buho Irrigation Area is 0.70 Ha. Prior to the construction of irrigation, different commodities were planted by farmers, namely rice (5.50 Ha), rubber (4.00 Ha) and cassava (8.75 Ha). The construction of the irrigation network has made farmers in the irrigated areas switch commodities to lowland rice with various growing seasons (Table 1.). The irrigation area has not been fully realized. This irrigation area still has a potential land area of 21.95 Ha which is planned to begin to be realized in 2023.

The Impact of Irrigation Development on Agricultural Productivity

The calculation of the effect of the construction of irrigation networks on agricultural productivity in the Way Tulung Buho Irrigation Area was carried out based on data from interviews from all 26 farmers whose land was served by irrigation water which will be calculated for their farming income. Analysis of farming income is used to determine the progress of the profitability of the agricultural business from year to year until the end of the business life. (Astrini et al., 2018) In analyzing farm icome, it is necessary to calculate the factors of production and agricultural productivity. In general, factors of production are grouped into four types, namely labor, land and other natural resources, capital, and entrepreneurs (Walton & Franck, 1991).

Table 2. Factors of Rice Production Before and After Irrigation Development

No	Production Factors	Per 0.69 Ha			Per Ha		
		Before	After	%	Before	After	%
A	Per season						
1	Seeds (Kg)	16.41	16.59	1.14	24.17	24.42	1.03
2	Fertilizer (Kg)						
	Urea	69.38	69.58	0.30	100.83	101.11	0.28
	Phonska	35.31	35.42	0.29	51.67	51.81	0.27
	KCL	34.69	35.83	3.30	50.42	52.64	4.41
3	Pesticide (lt)	5.09	5.50	7.98	7.42	8.08	8.99
4	Labor (HOK)	24.50	25.90	5.73	35.63	36.25	1.75
5	Agricultural Machinery (Day)	5.50	8.25	50.00	8.00	12.00	50.00
B	Per Year						
1	Seeds (Kg)	32.81	49.78	51.71	48.33	73.25	51.55
2	Fertilizer (Kg)						
	Urea	138.75	208.75	50.45	201.67	303.33	50.41
	Phonska	70.63	106.25	50.44	103.33	155.42	50.40
	KCL	69.38	107.50	54.95	100.83	157.92	56.61
3	Pesticide (lt)	10.19	16.50	61.96	14.83	24.25	63.48
4	Labor (HOK)	49.00	77.71	58.60	71.25	108.75	52.63
5	Agricultural Machinery (Day)	16.5	24.75	50.00	24.00	36.00	50.00

Source: Results of Data Processing (2023)

Production factors used in agricultural business in the Way Tulung Buho Irrigation Area include seeds, fertilizers, pesticides and labor. Analysis of the factors of production was carried out on eight farmers whose land use was lowland rice before and after the construction of irrigation so that the differences in production factors before and after the development specifically for rice plants could be seen. The use of these factors used in a year can be seen in Table 2.

Table 2. explains that there was an increase in production factors from before and after irrigation development. This is in accordance with research conducted by Fadli & Murdiana (2016) that irrigation plays a role in increasing water use and production factors. The increase in this production factor is directly proportional to the farmer's rice productivity.

Before the construction of irrigation, rubber plantation farmers produced rubber latex at an average of 5.25 tons per Ha per year. Cassava farmers produce 18.57 tons of cassava per 0.63 Ha per year (29.43 tons per Ha per year). Paddy productivity before and after irrigation development increased, namely in the first planting season of 1.13 tons/Ha (20.07%) and tons/Ha (25.39%) for the second planting season. In addition, cropping intensity increased to 300% on 9.50 Ha (12 farmers).

Table 3. Agricultural Productivity of the Way Tulung Buho Irrigation Area

No	Rice Production	Per Farmer (Tons)			Per Ha (Ton)		
		Before	After		Before	After	
A. Paddy – Paddy (n=8)		Per 0.69 Ha		(%)	Per Ha		(%)
	Commodity	Paddy	Paddy		Paddy	Paddy	
1	Planting Season 1	3.88	4.68	20.81	5.67	6.80	20.07
2	Planting Season 2	3.63	4.53	24.78	5.30	6.65	25.39
3	Planting Season 3	0.00	3.94	-	0.00	5.75	-
	Average	3.75	4.38	22.80	5.48	6.40	22.73
	Total	7.51	11.23	49.62	10.97	15.72	43.31
B. Rubber – Paddy (n=4)		Per 1.00 Ha			Per Ha		
	Commodity	Rubber	Paddy		Rubber	Paddy	
1	Planting Season 1	5.25	6.88		5.30	6.75	
2	Planting Season 2		6.63			6.58	
3	Planting Season 3		5.38			5.42	
	Average	5.25	6.29		5.30	6.25	
	Total		18.88			18.75	
C. Cassava – Paddy (n=12)		Per 0.63 Ha			Per Ha		
	Commodity	Cassava	Paddy		Cassava	Paddy	
1	Planting Season 1	18.57	4.22		29.43	6.80	
2	Planting Season 2		3.73			6.06	
	Average	18.57	3.98		29.43	6.43	
	Total		7.95			12.86	

Source : Analysis Results (2023)

In the third growing season, agricultural production tends to be smaller because the availability of water is not as much as in the other two seasons. Limited water availability in the third planting season occurs because this season coincides with the dry season (July–October) where rainfall and water availability in rivers decreases. Table 3. shows agricultural productivity data in the Way Tulung Buho Irrigation Area before and after irrigation construction.

To find out the significance of the increase in rice production, it is necessary to test the average difference (t-test) on rice productivity in the Way Tulung Buho Irrigation Area (Table 4). Based on the results of the t-test analysis, a significance value of 0.00 was obtained for the annual production of the first and second growing seasons. This means a significant difference at α 5%. Table 4. shows that there is a significant difference between rice productivity before and after irrigation development.

Table 4. Rice Productivity Average Difference Test

No	Description	*Mean*	*Std. Deviation*	t	df	*Sig. (2-tailed)*
1	Annual Production Before – After	5.738	2.044	-7.938	7	0.000
2	Production of Planting Season 1 Before - After	1.141	0.264	-12.234	7	0.000
3	Production of Planting Season 2 Before - After	1.346	0.397	-9.580	7	0.000

Source : Analysis Results (2023)

These results (Table 4) are in accordance with research by Haryono (2004) in Lampung which shows that the construction of irrigation networks can increase the amount of input used for production. The use of seeds increased from 28.84 kg/Ha to 57.67 kg/Ha, fertilizer from 227.74 kg/Ha to 455.48 kg/Ha, and pesticides from 1.39 gba/Ha to 2.78 gba/Ha. The logical consequence of this increase in production inputs is an increase in paddy rice productivity of almost seven times, from 352,054.79 Kg/Ha to 2,617.81 Kg/Ha (Haryono, 2004).

Another study was conducted by Akbar (2018) shows that the irrigation construction of the Bonecilla Reservoir increased planting intensity from 200% to 300%, increased the use of labor 180.26 HOK (Akbar, 2018). Lubis (2011) also explains that irrigation development can increase plantation index from 100% to 200% Rahayu (2014) also explained that partially irrigated rice fields in Karanganyar Regency most produce 2-3 times a year while the rice fields are rainfed 1-2 times (Rahayu, 2014).

There are three regional development indicators, namely based on development objectives, based on development resource capacity, and based on the development process. Based on development goals, regional development indicators include increasing productivity, increasing income and economic feasibility (Rustiadi et al., 2011). Based on one indicator of regional development with a development goal approach, namely increasing production, in this case is paddy rice production, that the utilization of irrigation areas has a positive and significant effect on regional development in Tiyuh Kibang Yekti Jaya, Lambu Kibang District, West Tulang Bawang Regency.

Socio-economic Impact of Irrigation Development

Organization Formation

The social impact that occurred in this area was the formation of the P3A organization. P3A (Association of Water Using Farmers) is an irrigation management organization that is a forum for water-using farmers in an irrigation service area or a village formed by conversion by water-using farmers including local irrigation management organizations. The development of irrigation networks has not been able to encourage the formation of a new agricultural management system, the use of irrigation water for social activities and there are no new interactions outside of the formation of the Water-Using Farmers organization, namely P3A Tiyuh Kibang Yekti Jaya. P3A Tiyuh Kibang Yekti Jaya was formed to manage the operation and maintenance of self-help irrigation networks.

This P3A charges farmers IDR 180,000.00 per Ha per season for irrigation operational costs which are used to pay sluice officers and maintenance costs for irrigation structures such as the cost of lubricants and sluice paint. The total costs charged to farmers in one year amount to IDR 8,271,000.00 according to the farming analysis in the attachment. Remuneration in the form of incentives aims to encourage and maintain the performance of the management. Budget allocation in the form of incentives can encourage innovation, achievement and performance of P3A (Teguh et al., 2022). In the case of P3A Tiyuh Kibang Yekti Jaya, the budget allocation that can be increased is in the form of decent wages for officers as well as operational and maintenance budgets so that there are no obstacles in terms of financing for the activities of the organization to achieve innovation, achievement and performance.

With the irrigation area development plan as well as the P3A organization improvement plan to become a legal entity, it is hoped that this 0rganization will become a thriving organization. To strengthen agricultural systems and management, it is necessary to have farmer groups that are gradually well institutionalized (Azhari et al., 2017). The addition of paddy fields from 18.25 Ha to 48.20 Ha will significantly increase the number of P3A members. Based on data from the Farmer Group in Tiyuh Kibang Yekti Jaya, if the paddy field is realized to the maximum, the number of existing farmers can reach 137 members. Thus, P3A requires more complex management. If the development of irrigation occurs optimally, the contribution required for the wages of administrators is IDR 29,400,000.00. For this reason, the fee required for a land area of 48.20 Ha is IDR 315,000.00 for a total of IDR 33,342,750.00 per year. The remaining contribution of IDR 3,942,750 can be used for maintenance and upkeep of irrigation and production facilities. The development of agricultural organizations is able to increase farmer participation in increasing rice productivity (Budiman et al., 2022).

Increased Revenue

The construction of Way Tulung Buho irrigation has an effect on the income of farmers who are affected by irrigation. The results of the analysis show an increase in the total income of 26 farmers. For farmers whose crops before and after development were rice, this development resulted in an increase in income of an average of IDR 25,931,375.00 per Ha per year. For farmers who were previously rubber plantation farmers, the increase in average income was IDR 54,163,000.00 per Ha per year and IDR 14,253,476.19 per Ha per year for farmers whose commodity is cassava. The average increase in farmers' income in a year for 26 samples was IDR 24,943,875.00 (140.82%) per 0.70 Ha per year or IDR 23,986,602.56 (69.96%) per Ha per year. The total increase in farmers' income in a year for this irrigation area reaches IDR 648,540,750.00 per year. To determine the significance of this increase in income, a different test was carried out on the average income of farmers in a year

Table 5. Income Before and After Irrigation Development per Year

No	Description	n	Income in a year (IDR)		Difference (IDR)	(%)
			Before	After		
1	Paddy – Paddy	8	215,824,000.00	399,737,250.00	183,913,250.00	85.21
2	Rubber – Paddy	4	67,062,000.00	291,703,000.00	224,641,000.00	334.98
3	Cassava-Rice	14	177,649,000.00	417,635,500.00	239,986,500.00	135.09
	Total	26	460,535,000.00	1,109,075,750.00	648,540,750.00	140.82

Source : Analysis Results (2023)

Table 5. shows that irrigation development is able to increase the income of farms served by irrigation Based on the results of the t test analysis, a significance value of 0.00 is obtained for an increase in annual income with α of 5%. Thus it can be concluded that there is a significant difference between the income of farmers before and after irrigation development. Table 6. shows the results of the t-test for differences in farmer incomes.

Table 6. Test The Difference In The Average Income Of Farmers In A Year

No	Description	Mean	Std. Deviation	t	df	Sig.
1	Income Before – After	24943875.000	20808890.608	-6.112	25	0.00

Source : Analysis Results (2023)

The results of Lubis' research (2011) explain that the development of DI Aek Riman, Tara Bintang District, North Sumatra which shows that the income of farmers who are served by irrigation is greater than those who are not served by irrigation (Lubis, 2011). The results of research by Ma'ruf et al., (2019) also show that the level of income earned by irrigated lowland rice farmers in Pitu Riawa District, Sidrap Regency is feasible to cultivate (Ma'ruf et al., 2019). Another study by Inayah (2022) explains that irrigation development has no positive effect on farmers' income (Inayah, 2022). The development of Cihea Irrigation in Cianjur Regency can significantly increase farmers' income per season (Dewi et al., 2014).This is in accordance with the situation in Tiyuh Kibang Yekti Jaya where irrigation development increases the income of farmers who are served by irrigation. This significant increase in income is in line with the indicators of development goals, namely increasing regional income.

Flood Impact

The construction of this irrigation network caused flooding in the rubber plantation area on the upstream of the weir with an area of 0.5 Ha. Flooding occurs when the irrigation control gate is functioning. Therefore, the operation of the irrigation network does not function optimally, namely only at night from 17.00 to 05.00 (GMT +7). This is done to avoid hampering rubber plantation activities which are affected by flooding during the day. As a result, the reach of irrigation water is not optimal. Currently, there are only 18.25 Ha (37.86%) of irrigated areas and 29.95 Ha (62.14%) of unirrigated areas.

In dealing with flooding due to river overflow, there are ways that can be taken, including river normalization and the construction of embankments to maximize the river's capacity to drain water (Abdillah et al., 2021). The flood that occurred on the Way Tulung Buho River required the construction of a 130-meter embankment along the flood-affected area so that flooding could be prevented from entering the rubber plantation. From the results of the analysis, it is estimated that the construction of the embankment will cost as much as IDR 367,941,087.80 according to the analysis of the unit price of West Tulang Bawang Regency which can be seen in the attachment.

Economic Feasibility Analysis of the Way Tulung Buho Irrigation Area Construction and Development Project

The construction of the Way Tulung Buho Irrigation Network has been carried out with a planned area of 40 Ha, a potential area of 48.2 Ha and a realized area of 18.25 Ha. This irrigation network has a network development plan in 2023 to 2024. The details of the costs for the construction of the Way Tulung Buho irrigation network can be seen in the Table 7.

Table 7. Investment And Operational Costs Of The Way Tulung Buho Irrigation Network

No	Description	Cost (IDR)
A	Irrigation Network Construction	
1	Construction costs	1,806,267,839.00
2	Operating Expenses (year)	150,000,000.00
B	Development Plan	
1	Secondary Channel	413,457,948.12
2	Flood Embankment	367,941,087.80
C	Organization	
1	Initial Formation Fee	2,000,000.00
	Total Investment Cost	2,589,666,874.92
	Total Annual Cost	158,280,000.00

Source : Analysis Results (2023)

Based on data from Table 5. and Table 7., the analysis of the economic feasibility of irrigation development in conditions before and after development, the results of which are listed in Table 8. Table 8 shows that the development of the Way Tulung Buho Irrigation Area is economically feasible and the plan to develop this irrigation area can be continued.

Table 8. Feasibility Analysis Of Way Tulung Buho Irrigation Construction

No.	Analysis	Value	Indicators	Mark
1	NPV (IDR)	871,654,962.97	NPV>0	Feasible
2	IRR (%)	26.91	IRR>12%	Feasible
3	Net B/C	1.63	BCR>1	Feasible
4	PP (years)	5.006	PP<10 years	Feasible

Source : Analysis Results (2023)

The irrigation area development plan will be carried out in the third to fourth years (2023 to 2024). If it goes according to plan, the development of this area will increase the potential for new land from non-rice paddy land to 29.95 Ha of lowland rice (a porence area that has not been irrigated). The planned land changes are 21 Ha of rubber and 8.5 Ha of cassava which will be converted into paddy fields. Land additions will be carried out in stages over three years, namely 10 Ha for the first year (2024), 10 Ha for the second year (2025) and 9.5 Ha for the third year (2026).

Based on farming analysis, the difference in profits from rubber farmers to paddy fields is Rp. 41,239,320.51 per Ha per year and from cassava farmers to paddy fields is Rp. 26,081,891.94 per Ha per year so that the total income to be obtained from increasing the area of paddy fields amounting to IDR 884,583,425.00 per year. The addition of paddy fields in the first year (2024) of 10 Ha provides an additional income of IDR 369,375,461.27, the second year (2025) of 10 Ha provides the same additional income as in 2024, while in the third year (2026) will increase by 9.45 Ha providing additional income of IDR 349,059,810.90. The results of calculating the NPV, IRR, B/C ratio, and Payback Period methods with a factor discount rate of 12% are in Table 9.

Table 9. Feasibility Analysis Of Way Tulung Buho Irrigation Area Development Plan

No	Analysis	Value	Indicators	Mark
1	NPV (IDR)	2,907,399,189.33	NPV>0	Feasible
2	IRR (%)	39.42	IRR>12%	Feasible
3	Net B/C	2.76	BCR>1	Feasible
4	PP (Years)	5.011	PP<10 years	Feasible

Source : Analysis Results (2023)

Based on the results of the economic feasibility analysis (Table 9) it is concluded that the irrigation area development plan is feasible. This is also in line with research by Kuadi et al., (2017) where the use of irrigation increases the feasibility of farming in Toluwaya Village, East Bulango District, Bone Bolango Regency (Kuadi et al., 2017). According to Rustiadi et al., (2011), based on development goals, one indicator of regional development is economic feasibility (Rustiadi et al., 2011).

CONCLUSION AND SUGGESTION

Conclusion

The construction of the Way Tulung Buho irrigation area increased rice production in Tiyuh Kibang Yekti Jaya, Lambu Kibang District, West Tulang

Bawang Regency by 1.13 tons/Ha (20.07%) in the first planting season and 1.35 tons/Ha (25.39%) for the second growing season in the form of harvested dry grain.

The socio-economic impact that occurred as a result of the Way Tulung Buho irrigation development was in the form of the formation of the Kibang Yekti Jaya P3A Institution which is active and will develop in line with the addition of new irrigated rice fields. Another impact is an increase in the average income of farmers served by irrigation of IDR 25,931,375.00 per farmer per year. Flood problems still occur due to the management of irrigation networks that have not been optimal.

Based on the project feasibility analysis, the construction of the Way Tulung Buho Irrigation Area has an NPV value of IDR 871,654,962.97, an IRR of 2% and a BCR of 1.63. The development plan for the Way Tulung Buho Irrigation Area has an NPV value of IDR 2,907,399,189.33, an IRR of 39.42% and a BCR of 2.76. The construction and development of irrigation areas is feasible and will encourage the development of the Tiyuh Kibang Yekti Jaya area, Lambu Kibang District, West Tulang Bawang Regency.

Suggestion

For farmers, village officials and the community in Tiyuh Kibang Yekti, with the construction of an irrigation network and a development plan, it is hoped that all parties can work together to maximize existing agricultural potential. Water management to maximize the reach of irrigation and to minimize flooding must be maximized to avoid social, economic and environmental problems. Maintenance of water structures and irrigation devices must also be considered so that the useful life of irrigation can be extended. This research can also be a consideration for farmers in irrigated areas whose commodities are still cassava and rubber to change their land commodities to paddy rice.

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