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IRRIGATION IMPACT OF FISH CULTIVATION FOR FARMERS INCOME AND ENVIRONMENTAL CONSERVATION (CASE STUDY IN BAKBAKAN VILLAGE GIANYAR)

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Abstract: **Fish cultivation in public waters is one of the efforts to increase fishery production through the expansion of fishery land by utilizing public waters. The purpose of this research is to find the impact of irrigation channel utilization for fish farming on farmer's income and environmental conservation in Bakbakan Village, Gianyar Regency.This research is quantitative descriptive. The utilized irrigation channel reaches 47 meters by spreading the seedlings of tilapia as much as 100 kg, with the maintenance until the harvest is 3 months given the feed and probiotics. Water on irrigation channels is analyzed in the laboratory against water quality parameters (in this case the physical and chemical parameters of water). Furthermore, farm income and farmers' feasibility analysis with R / C ratio (revenue cost ratio).**

Keywords: **Irrigation, fish cultivation, environmental conservation.**

I. INTRODUCTION

Indonesia is one of the countries with the greatest potential natural resources around the world, one of them in the field of marine and fisheries, but in terms of utilization has not seen the maximum effort of the people of Indonesia to optimize fisheries and marine resources. The marine and fishery sector has a major role in creating local food security if it is optimally optimized.

Fish cultivation in public waters is one of the efforts to increase fishery production through the expansion of fishery land by utilizing public waters. Moreover, Indonesia has a very wide public waters and very potential for the development of aquaculture.

By utilizing the public water resources optimally while maintaining its sustainability, the national development of the fishery sub-sector is expected to increase. With the increase of this fishery sub-sector, it is expected to increase the income of the community, increase the need for fish consumption, increase employment, increase the country's foreign exchange, and increase the use of natural resources and environment for the benefit of the community.

Gianyar Regency is one of nine regencies / cities in Bali Province, with an area of 36,800 hectares or 6.53% of the total area of Bali as a whole. The situation until the end of 2015 has a land area of 14,420 hectares, supported by the hydrology of its territory which has a variety of water sources for irrigation. Judging from the availability of land resources,

hydrological conditions, and climatology, Gianyar Regency has great potential for the development of freshwater aquaculture. Potential of freshwater aquaculture can not be utilized optimally because there are still many obstacles and problems. At the end of 2015 ponds, pond / tebat / pond extent reaches only 158 hectares (Gianyar Dalam Angka, 2016).

Bakbakan Village as one part of Gianyar District, with 405.6 Ha, dominated by 224 Ha and 132 Ha. Natural resources available in the form of springs of groundwater sources that can serve as irrigation irrigation sources. In the middle of the village flowed by a small river to flow the rice fields, to the west and east flanked by the Yeh Ayung river and the east flanked by the river Tukad Cangkir. The irrigation area in Bakbakan Village consists of a potential area of 190 hectares, of which 171 hectares are functional.

One of Banjar Dinas area in Bakbakan Village is Banjar Gitgit. The existing irrigation areas in the Banjar Gitgit area consist of 44.25 hectares of potential area and 38.25 hectares of functional area. Along the residential areas of Banjar Gitgit flowing irrigation flow that the water is almost never dried and downstream to rice fields. Therefore the situation is used by local people who are members of a group of fish farmers as a place of fish cultivation of freshwater species of tilapia.

II. BODY OF ARTICLE

The study was conducted during the period of November 2017 to January 2018. The research was conducted in an irrigation channel at Banjar Gitgit Bakbakan Village, Gianyar Regency. The study focused on irrigation channels with length of 47 meters with an average water height of 26 cm. Type of fish stocked is tilapia, at the beginning of as much as 100 kg, with feeding 3% of fish body weight, given 2 times a day. Type of feed given is hi-pro-vite, to stimulate the growth of fish weight, added with probiotics.

The data used are primary data and secondary data. Primary data in the form of weighing fish weight at the beginning of stocked up to harvest, and also result of laboratory test of water samples in irrigation channel which become place of fish cultivation at Banjar Gitgit Bakbakan Village, Gianyar. Water on irrigation channels is analyzed in the laboratory against water quality parameters (in this case the physical and chemical parameters of water). Secondary data in the form of data collected from the Central Statistics Agency of Gianyar Regency as well as from other literature.

To calculate the business analysis conducted can be used analysis Net cash income (Cash), is the difference between all receipts with all expenditure during the production process takes place. R / C ratio analysis (Revenue Cost Ratio) is a business feasibility analysis to measure business return rate in applying a technology, as a benchmark of revenue and cost.

This research is a survey research. Water sampling is done by purposive sampling method. Water sampling was taken and focused on the upstream and central parts of the irrigation canal. At the point of observation, we take samples of irrigation water for water quality measurement. Water samples were analyzed in the laboratory to obtain data according to parameters established in water quality irrigation water.

The parameters analyzed are those included in the physical and chemical parameters of water. These physical parameters include odor, soluble solids, tertusoensi solids, turbidity, temperature, color. As for the chemical parameters such as Arsenic, Ammonium, Iron, Copper, Chloride, Manganese, Nitrate, Nitrite, pH, Cyanide, Sulphate, Organic Substances, Free Chlor, and Conductivity.

This water quality parameter refers to Government Regulation No. 82/2001 on Water Quality Management and Water Pollution Control of class II water category that is for freshwater fish cultivation.

Tilapia farming in Gitgit irrigation channel Bakbakan Village begins by choosing irrigation channel which will serve as fish farming place, that is 2 channel with total channel length 47 meter, channel width 0,6 meter and average water height 26 cm. This channel was chosen because of its location close to the residential area and the size of the irrigation is not too large.

The type of freshwater fish selected for cultivation is tilapia. Tilapia (Oreochromis niloticus) is one of fishery commodities that are popular with the community in meeting the needs of animal protein because it has thick meat and good taste.

Distribution of seedlings in irrigation channels, by spreading nile tilapia seeds as much as 100 kg with size 13 (per kg consisting of 13 tails) obtained from the purchase at the sale place of tilapia seedlings in Sidembunut area of Bangli regency. The selected tilapia seeds are nil type Gesit (blackish white). Tilapia this type of seed is more widely available and easier to maintain.

Nile type of tilapia seedlings with size 13 size is obtained at a price of Rp 18.000,00 per kilogram with the number of fish per kilogram is 10 to 13 tails. For 100 kg of tilapia seedlings obtained by the number of fish that is about 1300 tilapia seedlings with size 13. Tilapia seedlings with size 13 is selected for maintenance period or fish enlargement period can be shorter ie 3-4 months. The next activity after getting the seeds of tilapia, which is to spread the seeds of fish on the irrigation channel that has been prepared, by spreading in each channel as much as 50 kg of tilapia. The activity of the spreading of tilapia seedlings is done in the morning, the sun is not too hot, the weather is bright and the flow of irrigation water in good condition.

Picture 1: Gitgit Irrigation channel

In picture 1. above shows that the irrigation channel that is used as the cultivation of tilapia fish looks clean and the water also looks clear. At each end of the channel there is a bulkhead so that the garbage is not directly about the fish, and the fish does not float downstream. This method is chosen because it is suitable with small and somewhat narrow irrigation conditions.

The cultivation of tilapia in Gitgit irrigation channel is conducted for 3 months ie from November 2017 to January 2018. During this maintenance period, members of the fish farming group rotate in maintenance activities, measuring the size of fish and monitoring the flow of irrigation water from dirt or garbage originating from upstream and monitoring irrigation water discharge every day.

In the period of tilapia fish enlargement given feed fish (pellets) type of hi-pro-vite as much as 3% of fish body weight with the frequency of feeding 2 times a day ie in the morning and afternoon. In addition to feed in the form of pellets, this tilapia can be given additional probiotics are mixed into the fish feed. Conversion of feed is influenced by the absorption of nutrients feed by the digestive tract. Fish digestive tract contains microorganisms that help the absorption of nutrients.

Provision of probiotics in tilapia is given by mixing on the fish feed and then dianginkan shortly before given to tilapia. Probiotics can help maintain the digestive system of fish to be better so as to optimize the absorption of nutrients in fish. So that the weight of fish becomes faster and increase the meat-forming in the fish, the rest of which become dirt only a small amount, so as not to pollute the surrounding water.

To know the development of the weight and size of tilapia are kept, done by weighing the fish every week by taking samples of several fish to measure the weight and size.

The development of the weight and size of tilapia maintained on irrigation can be seen in Graph 2 below.

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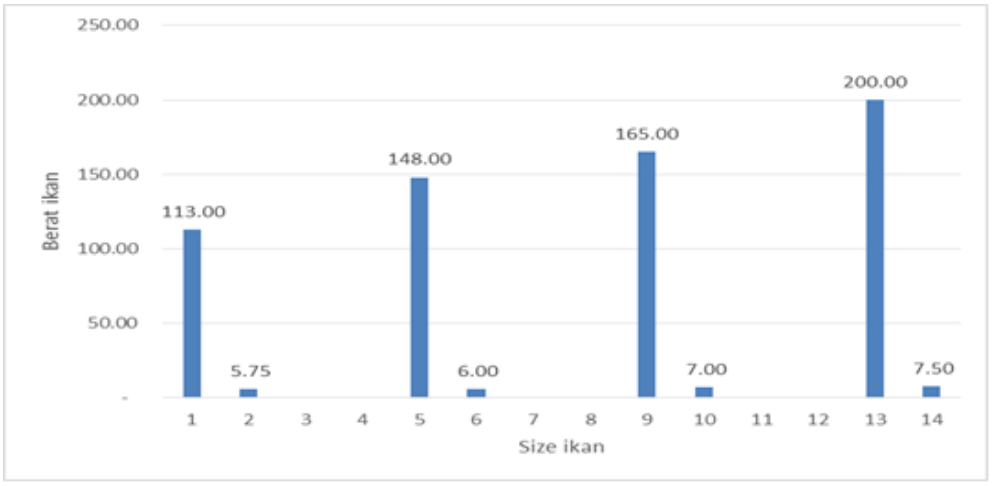

Graph 2: Average growth in weight and size of tilapia maintained on irrigation channels

In Graph 2, it appears that tilapia grown on irrigation channels together have an average increase in both weight and size. Fish production on irrigation channel, calculated by weighing the fish, using sample of 10 tilapia fish, at the beginning of weight distribution of fish average 113,00 gram, with average size 5,75 cm, at age one week (first week) in the second week the average weight of the fish increased to 148.00 grams, with an average size of 6.00 cm, in the third week increased on average to 165.00 gr with average size of 7.00 cm and then on the week the fourth has increased the average weight to 200.00 gr with the average size to be 7.50 cm.

From the spreading of tilapia seeds as much as 100 kg at the beginning, can be obtained by tilapia as much as 244 kg with average size 3 (per kg contains 3 fish), and 62 kg of tilapia fish with size 7 (per kg containing 7 fish) . With an average weight of 250 grams of fish per tail, then the tilapia is already feasible for general consumption.

Fish weighing and measurement activities are conducted to monitor the growth of tilapia. The measurement results show that the average size of the previous tilapia 164 gram with length 19,67 cm and width of fish 6,92 cm. At the time of the second month the weight of the fish increases, reaching an average of 233 grams with a length of 21.20 cm fish and a fish width of 7.50. In the third month the weight of the average fish increased to 332 grams, length 25.3 cm and 9.30 cm wide. At this stage, fish can be harvested for consumption or sale.

Probiotics given to fish feed as much as 20 gr / kg, by way of sprayed on the feed and then dianginkan until dry before being given to the fish. Probiotics is what helps the fish in the absorption of feed consumption to be better so that the food consumed by fish can be ingested into meat, while the dirt is only a little. Therefore, water-soluble fish feces do not affect water quality.

Farmers' income (Net Cash) is obtained from the sale of tilapia that has been harvested, calculated the weight and total fish. The results of this tilapia fish sale will be reduced by the cost incurred from the beginning of the fish until the harvest, will get the difference between them, that is the income of the fish farmers. The Net Cash farmers are described in Table 3 below.

Table 3: The total net income of tilapia farmers

Description	Volume	Price (Rp)	Total (Rp)
Sale of fish size 3	244 kg	27,000	6,588,000
Sale of fish size 7	62 kg	22,000	1,364,000
Total Revenue/TR			***7,952,000***

Description	Volume	Price (Rp)	Total (Rp)
Cost of seeds	100 kg	18,000	1,800,000
Feed cost	10 sak	288,000	2,880,000
Total Cost/TC			***4,680,000***
Net Cash (TR - TC)			***3,272,000***
R/C ratio			*1.70*

From table 3 it can be seen that the income of farmers is obtained from the sale of tilapia Rp 7.952.000,00. Total Cost is Rp 4,680,000.00. The net income of fish farmers in Gitgit irrigation channel is Rp 3,272,000, -. R / C ratio (Revenue Cost Ratio) or business feasibility of cultivation of this type of tilapia obtained by 1.70. This means that the capital expended by the farmers in this tilapia cultivation activity will be returned almost two and a half times in each fish cultivation.

Fish farmers who participated in the activity of tilapia farming in Gitgit irrigation channel namely Mekar Mina Lestari Group. This group of farmers has a total number of group members of 18 people entirely from Bakbakan Village. Aside from being a fish farmer, the group members who are members of this fish farming group also work as paddy farmers as well as construction workers. The activities of raising tilapia in irrigation canal is a side activity besides their main business. Characteristic data of fish farmers in Gitgit Bakbakan Gianyar Village is seen in table 4 below.

Table 4.Characteristics of fish farmers in Gitgit Bakbakan Village

No	Characteristics	Interval	Total		Average
			Person	Percentage (%)	
1	Age (year)	28 - 39	5	50.00	48
		40 - 51	9	50.00	
		52 - 64	4	22.22	
2	Level of education (year)	3 -7	8	44.44	9
		8 - 11	9	50.00	
		12 - 16	1	5.56	
3	Long experience (year)	4 - 6	19	44.19	5
		7 - 9	18	41.86	
		1 - 3	17	94.44	3
		4 - 5	1	5.56	
		6 - 9	0	0.00	
4	Number of family dependents	2 - 3	4	22.22	5
		4 - 5	8	44.44	
		6 - 7	6	33.33	
Total			18	100	

Sumber : Data Primer diolah, 2017

The data in Table 4 shows that the average age of respondents is still at a productive age of 48 years. The average age of fish farmers in Gitgit Bakbakan Village is still at the productive age so that will give maximum results on the cultivation undertaken.

Judging from the duration of education, the average fish farmers in Gitgit Bakbakan village have junior secondary education level. Table 4 shows that the average length of respondent education is 9 years. The location of Bakbakan Village is not too far from the city center and the availability of many formal education facilities such as schools makes awareness of the education of the community increases.

Based on table 4, it can be seen that the largest percentage of farmers who have tilapia fish farming experience for 1 - 3 years is 94.44%. This shows that farming experience owned by tilapia farming farmers is relatively new and still in the stage of sharpening skills, ranging from the mastery of the theory of tilapia farming enlargement, how to enlarge the good tilapia to the management of good farm management.

Characteristics of other respondents such as the number of family dependents. On average each respondent in each group of respondents is 5 people. The average number of family members in these fish farmers is low so that food, health and education needs can be met well.

Water sampling is done on the upstream and central irrigation (locations 1 and 2) assuming that in both parts already represent the condition of irrigation water quality. This water inspection is adjusted to the physical and chemical

parameters of water according to the water quality standard in accordance with the Government Regulation of the Republic of Indonesia Number 82 Year 2001 on the Management of Water Quality and Control of Water Pollution. Results of laboratory tests of irrigation water samples in Banjar Gitgit Bakbakan Gianyar as shown in Table 5.

Table 5. Results of laboratory tests of irrigation water samples in Banjar Gitgit Bakbakan Gianyar

No	Parameter	Unit	Class				RESULTS		
			I	II	III	IV	Upstream	The Middle (part 1)	The Middle (part 2)
PHYSICS									
1	Smell	-	-	-	-	-	No Smell	No Smell	No Smell
2	Dissolved solids	mg/L	1000	1000	1000	1000	202,13	258,58	271,94
3	Suspended solids	mg/L	50	50	400	400	5,10	6,0	8,35
4	Turbidity	NTU	-	-	-	-	5,85	7,10	8,57
5	Temperature	°C	Deviasi 3	Deviasi 3	Deviasi 3	Deviasi 5	26,3	26,4	26,4
6	Colour	TCU scale	-	-	-	-	4,0	5	5,0
CHEMICAL									
1	Arsenic (As)	mg/L	0,05	1	1	1	TTD	TTD	TTD
2	Ammonium (NH_4)	mg/L	0,5	-	-	-	0,085	0,10	0,18
3	Iron (Fe)	mg/L	0,3	-	-	-	0,16	0,092	0,092
4	Copper (Cu)	mg/L	0,02	0,02	0,02	0,02	0,014	0,016	0,018
5	Chloride (Cl)	mg/L	600	-	-	-	6,67	6,67	6,67
6	Mangan (Mn)	mg/L	0,1	-	-	-	0,084	0,092	0,092
7	Nitrate	mg/L	10	10	29	20	7,10	5,20	5,80
8	Nitrite	mg/L	0,06	0,06	0,06	-	0,025	0,046	0,018
9	pH	mg/L	6-9	6-9	6-9	5-9	7,4	7,3	7,3
10	Cyanide (CN)	mg/L	0,02	0,02	0,02	-	TTD	TTD	TTD
11	Sulfate (SO_4)	mg/L	400	-	-	-	8,0	21,0	12,0
12	Organic substances	mg/L	-	-	-	-	6,45	7,44	8,60
13	Free Chlor (Cl_2)	mg/L	0,03	0,03	0,03	-	TTD	TTD	TTD
14	CONDUCTIVITY	µmhos/cm	-				333	426	448

TTD : Not Detected

According to table 5 above, the results of the measurement of the physical parameters for the dissolved solids for the upstream section are 202.13 mg / L, in the middle (1) irrigation 258.58 mg / L and 271.94 mg/L for the middle (2) irrigation. The sample value for this parameter is still below the maximum limit for class II water that is 1000 mg / L of freshwater fish cultivation and landscaping. Solids in natural waters are usually salt and other organism molecules. For irrigation water that is used as a place of tilapia fish culture, that is class II water, the dissolved solids content is still in a reasonable stage.

Suspended solids in the upstream 5.10 mg / L, in the middle (location 1) 6.0 mg / L and the middle (location 2) 8.35 mg / L. The maximum value for class II is 50 mg / L. Solid substances Suspended on the central irrigation channel (location 2) is higher due to the presence of more clay content in the water than in the upstream and the middle (location 1). For class II water, the content of suspended solids in Gitgit irrigation water is still good.

In terms of turbidity of water is at 5.85 NTU for the upstream, 7.10 in the middle (location 1) and 8.57 NTU in the middle (location 2). In Government Regulation No. 82/2001 there is no mention of the maximum limit for water turbidity. Turbidity can be caused by suspended and dissolved organic and inorganic materials, such as mud and fine sand. According to observations, turbidity levels on Gitgit irrigation channels are still good for fish maintenance.

Water temperatures are in the range 26.3 ° C in the upstream and 26.4 ° C in the middle (locations 1 and 2) of irrigation channels, where the standard for class II is deviation 3. According to PP No.82 of 2001 (class II) the temperature range for freshwater aquaculture activity is deviation 3 whereas good water temperature tolerance to support optimal growth of some freshwater aquaculture fish such as mas and indigo is 28 ° C. This indicates that the water temperature in Gitgit irrigation channel is still feasible and qualified for fish farming business.

The result of chemical parameters examination at the upstream and middle part ie, Arsenic substance is not detected, where the threshold is 1 mg / L for class II. In the Gitgit irrigation channel, no arsenic is found, so the irrigation water is safe for fish cultivation.

Ammonium was 0.10 mg / L in the upstream and 0.18 mg / L in the middle (location 1) and 0.085 mg / L in the middle (location 2). There is no Ammonium limit for class II water to class IV water. Ammonium levels in this water are usually obtained from the remaining fertilizer plants containing urea and the disposal of animal waste into the water stream. In the Gitgit irrigation channel, the ammonium in the central part of the irrigation is detected very little, but in contrast to the higher upstream of the central part of the irrigation, it is possible in the upper reaches that more pig droppings originating from the surrounding homes are washed away by rainwater and into the irrigation stream.

Iron (Fe) obtained value of 0.16 mg / L in the upstream and 0.092 mg / L in the middle (location 1 and 2), there is no maximum limit of value of Iron (Fe) in class II water class according to Government Regulation No. 82 of 2001 on the Management of Water Quality and Control of Water Pollution. Differences in the amount of iron content (Fe) in the upstream can be caused by a pile of garbage cans contained on the edge of irrigation. Little by little the iron in the garbage can is dissolved by the water passing through it.

The value of copper (Cu) for upstream was 0.014 mg / L and in the central part of irrigation (location 1) obtained copper (Cu) 0.016 mg / L and in the center of irrigation (location 2) of 0.018 mg / L, while the threshold the limit for water in class II is 0.02 mg / L. From the results of laboratory tests showed that the level of Copper (Cu) in GIggit irrigation water is almost close to the limit of quality standards according to Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control ie 0.02 mg / L. The presence of Copper (Cu) content in Gitgit irrigation water can be caused by the presence of household waste containing elements of Copper (Cu).

Chloride (Cl) obtained value of 6.67 mg / L in the upstream and middle. There is no maximum limit of chloride for class II water category. Chloride (Cl) contained in Gitgit irrigation water is likely to originate from the remnants of household waste originating from nearby residents.

Upper Manganese (Mn) in the upstream area is 0,084 mg / L and in the middle (location 1 and 2) 0,092 mg / L. For the category of class II water, there is no limit on the maximum value for this manganese (Mn). Manganese (Mn) in Gitgit irrigation water is still safe category for freshwater fish culture.

Upper Nitrate substances contain 7.10 mg / L and in the middle (location 1) there is a value of 5.20 mg / L and the middle (location 2) 5.80 mg / L, lower than the maximum value for class water II ie 10 mg / L. The presence of Nitric substance content in Gitgit irrigation water is caused by the presence of household waste containing nitrate elements, into the irrigation water flow. Nitrate is a source of nutrition for phytoplankton and other types of aquatic plants. If the high nitrate content can cause a lot of water plants that live in the waterways.

Upper Nitrite content of 0.025 mg / L and in the middle (location 1) 0.046 mg / L and center (location 2) 0.018 mg / L, while the maximum value of nitrites according to Government Regulation No. 82 of 2001 on Water Quality Management and Control Water pollution is 0.06 mg / L. The nitrite substances present in the Gitgit irrigation canal does not exceed the standard class II water. The content of this nitrite can be caused by the presence of domestic waste derived from community activities around irrigation such as washing and other household waste.

The pH of water on the upstream of the irrigation canal is 7.4 mg / L and in the middle (locations 1 and 2) of the 7.3 mg / L irrigation channel, where the pH appropriate for class II class water is 6-9 mg / L. The pH of water on Gitgit irrigation canal is classified as class II water and suitable for freshwater fish culture.

The cyanide content (Cn) in the upstream and the middle of the irrigation is undetectable, meaning there is no substance in the Gitgit irrigation water. Sulfate content (SO_4) on the upstream of the irrigation channel with a value of 8.0 mg / L and in the middle (location 1 and 2) irrigation channels with a value of 21 mg / L, there is no maximum value for Sulfate substances in class II water until with class IV. Sulfate content in Gitgit irrigation water is still normal for cultivation of freshwater fish.

Ingredients of Organic Substances in the upstream of the irrigation channel 6.45 mg / L and in the middle (locations 1 and 2) of irrigation channels 7.44 mg / L, there is no limit on the value of organic substances in all categories of water classes from class I to class IV. Organic substances (KMnO4) are common indicators for contamination. Therefore, in Gitgit irrigation water there is no contamination of organic matter.

Free Chlor in the upstream and the central part of irrigation is not detected, this indicates that the absence of such substances in Gitgit irrigation water.

Conductivity or DHL of Gitgit irrigation water, upstream 333 µmhos / cm and in center (location 1) 426 and (location 2) 448 µmhos / cm, no maximum value for Conductivity value in attachment PP number 82 Year 2001 on Water Quality Management and Water Pollution Control. In the US Salinity Lab Staff, 1954, water quality criteria for irrigation water say values should not have DHL> 2250 µmhos / cm. Therefore, the conductivity contained in Gitgit irrigation water is still safe for freshwater fish cultivation.

From the result of the examination that the physics and chemical parameters of the water that have been tested, on Gitgit irrigation water, there are no parameters that exceed the standard of class II water quality as determined in accordance with Government Regulation No. 82/2001 on Water Quality Management and Water Pollution Control. So, the condition of irrigation water in Banjar Gitgit Bakbakan Village is safe for cultivation of freshwater fish and for landscaping.

Constraints faced in the cultivation of tilapia fish irrigation channel that is when there is heavy rain and continuously in the maintenance of fish in irrigation channels, will affect the amount of water debit in the upstream so that it can cause tilapia are kept drifting by the flood. The second constraint is the disposal of household waste discharged into irrigation flows, which come from local residents around irrigation canals, which can affect the quality of irrigation water. Another constraint that is the closure of water flow in the upstream irrigation caused the transfer of water flow under certain conditions. This water closure usually lasts only a few hours.

III. CONCLUSION

Farmers get additional income from tilapia farming in Banjar Gitgit Bakbakan irrigation channel of Rp 3.272.000,00 and business feasibility with value of 1.70 this means every effort done in one million rupiah of capital owned by farmer will be returned one million seven hundred thousand rupiahs per one-time harvest period.

Sustainable environment with irrigation water quality of class II category refers to Government Regulation Number 82 Year 2001 regarding Water Quality Management and Water Pollution Control, in good condition for freshwater fish cultivation or cultivation.

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