PROFITABILITY AND RESOURCE USE EFFICIENCY OF POLYCARP PRODUCTION IN MORANG, NEPAL

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ABSTRACT

The study was designed to portray the resource use efficiency of polycarp production in Morang district of Nepal during December 2017 to April 2018. Total of 30 commercial and 30 subsistence farmers were selected for primary data collection. Cobb-Douglas non-linear regression function was used to determine inputs that affect productivity. Empirical results illustrated the enterprise to be profitable as indicated by Benefit Cost Ratio, 1.87 in commercial and 1.33 in subsistence farms. The income of commercial farms was significantly higher (NRs. 76.94/kg) than subsistent farms ($p<0.01$). Estimates suggested feed and labor to be reduced; proper use of lime, fertilizer, other cost and pond rent to be increased. Therefore, the fishery enterprise is in the stage of higher potentiality to increase its production in the study area.

Keywords: *Cobb-Douglas, commercialization, cost, profitability, carp polyculture*

INTRODUCTION

The immense water resource and varied agro-climatic zones has supported several indigenous fish species which has great role in balancing the biodiversity as well as in income generating activities in Nepal – especially, landless, marginal farmers (DoFD, 2013) and Nepalese indigenous communities like *bote, majhi* and *mallahas.* The Nepal Agriculture Perspective Plan (APP) has categorized Nepal fishery enterprise, a small but important and promising sub sector of agriculture in the country (DoFD, 2006).

Fisheries and aquaculture remain important sources of food, nutrition, income and livelihoods in Nepal with annual fish consumption of 2.07 kg per person per year in 2010 and still provided more than 3.1 billion people with almost 20% of their average animal protein uptake (FAO, 2016). Similarly, 0.48% of National GDP is contributed by fisheries sector (MOAD, 2018) and is an efficient source of animal protein. Eastern Terai region of Nepal is considered as potential hub for fish farming. Morang District has 2,912 total ponds with 583.26 hectares of wetland area. The average production and productivity of the district is 2,948,932 kilograms and 5.056 ton/ ha respectively (DoFD, 2017). Prime Minister Agriculture Modernization Project is the supporting project under 20 years Agriculture Development Strategy (2015-2035). This project has envisioned zone implementation program in three different location of Morang district namely Katahari and Dhanpalthan Rural Municipalities and Rangeli Municipality. Its aim is to increase the production, commercialize and modernize the fish production system to increase self-sufficiency and independency (PMAMP, 2017).

Although, there is high possibility of fish farming in eastern Nepal, profitability and productivity of pond fishery enterprises in Morang, Nepal had not been studied. In absence of plenty information regarding allocation of resources for production of carp polyculture, the farmers of this district devoid the remunerative profit of their product (Dhungana, Dutta & Dhakal, 2016). The findings from case study of natural and manmade ponds at a village in peri-urban area of Gorakhpur, Uttar Pradesh, India shows that the investments in ponds have a total NPV of NRs. 202,405.69 and benefit to cost ratio is 1.52 at a social discount rate of 12% while the breakeven can be achieved in the fourth year itself (Singh, 2015). A study on economics of fish production in Bharatpur district, Rajasthan, India conducted by Kumar et al. (2013) found the B/C ratio to be 2.19 with average gross return of 76,240.90 and net return of 61,618.47 per ha. The benefit cost ratio in Beel fish farming was 2.86 and in case of pond fish farming it was 1.95 in Kishoreganj district, Bangladesh (Uddin and Farjana, 2012). The B/C ratio of fish farming in Nigeria was 1.65 with profit cost ratio of 0.65 (Olasunkanmi, 2012). The study in the private farm located at the vicinity of Thatta, Sindh, Pakistan reported by Karim, Shoaib and Khwaja (2016) obtained B/C ratio as 1.91. The profitability of fisheries sector is measured through an empirical analysis of the costs and revenues of the enterprise (Smith and Peterson, 1982). Paying evaluative attention to the financial aspects of the production can led to success of enterprise (Mwangi, 2007). Wagle (2016) studied the logical relationship between production and expenditure as well as labor for understanding the production function of agriculture in Nepal using Cobb Douglas Production Function model. The results of the Cobb-Douglas models appeared to be superior on theoretical and econometric grounds (Saha et al., 2004). The results from Ghana, South Africa indicate that the total area of ponds, weight and size of fingerlings and feed had a significant and positive relationship with fish output (Crentsil & Ukpong, 2014). Similar relation was used by Karkacier (2001) to calculate resource use efficiency and production of fishery enterprises in Lake Durusu, Turkey.

Thus, farmers must consider production cost and yield which ultimately affect sustainability of any farm. Profitability study on pond fish production is expected to illustrate the valuable information relating to farms and farmers adopting carp poly-culture in huge scale or in small scale. The primary objective of the study is to portray the determinants of fish output, analyze profitability and resource use efficiency in the three regions in Morang district. To make profitability and productivity analysis of commercial and subsistent fish farmers, the first step has been realized by the present study.

MATERIALS AND METHODS

Study site and time frame

Morang district was purposively selected for the study. The reason behind the purposive selection of this district as these areas has been appointed as zone program implementation sites under Prime Minister Agriculture Modernization Project (PM-AMP). Three Municipalities namely Katahari Rural Municipality, Dhanpalthan Rural Municipality and Rangeli Municipality were selected for the study. Alongside, the district has high potentiality of fish production provided by the sufficient water resources and swampy land accompanying accessibility to road and market. This study was conducted from December 2017 to April 2018.

Morang is one of the districts of Province number 1 of Federal Democratic Republic of Nepal and has Province Capital; Biratnagar as its main city. It lies in Koshi Zone of Eastern Development Region with coordinates latitudes 26°20’ to 27°10’ N and longitudes 87° to 87°30’ E. The climate varies from tropical to temperate with 1312 mm average annual rainfall, and 30.6°C and 14.2°C the average maximum and minimum temperatures respectively (DADO, 2016).

Sampling and data collection

For the purpose of collecting data, a list of farmers involved in fish farming in three study sites was obtained from DADO, Morang and various secondary data were retrieved from DADO, Directorate of fisheries development, Central Bureau of Statistics, Nepal Agriculture Research Council and PM-AMP. Out of 600 fish growing households, altogether 60 farmers i.e. 10% of total population size were selected using simple random technique. Out of 60 HHs, 30 HH belong to commercial scale of production and 30 HH belong to subsistent scale of production. In this research, farm type was categorized into two namely, commercial and subsistent based on water surface area as mentioned by PM-AMP where farm with water surface greater than 0.2 ha (>6 kattha) are commercial farms and water surface smaller than 0.2 ha (<6 kattha) are subsistent farms (PM-AMP, 2017). Primary data was collected with the use of semi-structured interview schedule using face to face interview technique, key informants' interview and focused group discussion.

Data analysis

The collected information was coded and entered in Excel data entry sheet and analyzed by using Statistical Package for Social Science (SPSS) version 22 and Microsoft Excel. Collected data were analyzed with descriptive and quantitative methods.

Cost, return and profitability:

All fixed cost like pond rent per year and depreciation of equipment and machineries used in fish farms like pipes, motor, pump set, generator, boring, aerator, fishing net, farm buildings, etc. and variable inputs like human labor, lime and fertilizer, feed and other costs were taken under consideration and valued at current market prices of the year 2018 to calculate cost of production. According to Dhungana, Dutta & Dhakal (2016);

$$TC = TFC + TVC$$

Where, TC= Total cost, TFC = Total fixed cost, TVC = Total fixed cost

$$TVC = C_{labor} + C_{lime\ and\ fertilizer} + C_{feed} + C_{others}$$

Where,

C_{labor} = Total cost of labor in NRs.,

$C_{lime\ and\ fertilizer}$ = Total cost of lime and fertilizer in NRs.,

C_{feed} = Total cost of feed in NRs.

C_{others} = Total Cost of fish seed, irrigation, transportation, maintenance, fuel, electricity and medicines in NRs.

$$\text{and } TFC = C_{land\ rent} + C_{depreciation}$$

Where,

$C_{land\ rent}$ = Total land rent per year in NRs. and

$C_{depreciation}$ = Total depreciation cost in NRs. Depreciation was charged at the rate of 10% per annum.

Revenue is the product of total fish production and unit price of the produce. Gross margin was calculated by using the method as given by Okeoghene (2013) using following formula.

Gross margin (NRs/ kg) = Revenue/kg – Total variable cost (TVC)/ kg

and Net margin is calculated as;

Net Margin (NRs/ kg) = Gross margin (NRs./ kg) – Total Fixed Cost (TFC)/ kg

The purpose of calculating benefit cost is to determine whether the investment made on the resources yield the reasonable return or not. Benefit Cost Ratio (BCR) is assumed to be a quick and one of the easiest methods for evaluating the economic performance of any business/ farm (Dhakal et al., 2015). Undiscounted benefit cost ratio was estimated as a ratio of gross return and total variable cost. The BCR analysis was carried out by using formula;

$$\text{B/C Ratio} = \frac{\text{Revenue}(\text{NRs./kg})}{\text{Total Cost}(\text{NRs./kg})}$$

Production function

Jhingan (2007) stated that production function expresses a functional relationship between quantities of inputs and output. It shows how and to what extent output changes with variation in inputs (Sharma, 2016). Cobb-Douglas type of production function was used to determine the contribution of different factors on production and to estimate the efficiency of the factors of production in poly carp production. The following form of production function was fitted to examine resource productivity, efficiency and return to scale.

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^u$$

Taking natural log on both sides,

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + u$$

Where,

Y= Gross return (NRs/ ha) = Total quantity produced (kg/ha) * Price of fish (NRs. /kg)

a = Constant or Intercept of the function,

X_1 = Labor cost in NRs. /ha,

X_2 = Lime and Fertilizer cost in NRs. /ha,

X_3 = Feed cost in NRs. /ha,

X_4 = Other cost in NRs. /ha,

X_5 = Land Rent/yr in NRs. /ha,

X_6 = Depreciation in NRs. /ha

ln= Natural log

u= error terms

b_1, b_2, b_3.= Coefficient of respective variables

Cobb-Douglas function was assumed as the functional form of the production function. This was because it is linear in its logarithmic form, and therefore easy to estimate by using ordinary least squares estimation technique (OLS).

Resource use efficiency

The marginal value products (MVPs) of the input used were estimated by multiplying the average value product (AVP) of an input with its elasticity of production (b_i). The resource use efficiency (r) was estimated by dividing the marginal value product (MVP) by marginal factor cost (MFC). The value thus obtained was tested for its equality to one i.e. (MVP/ MFC)=1.

As suggested by Dhungana, Dutta & Dhakal (2016), Goni et al. (2013) and Karkacier (2001);

$$\text{For the } i^{th} \text{ resource/ input, } AVP_{Xi} = \frac{\overline{Y}}{\overline{X1}}$$

$$MVP_{Xi} = b_i \times AVP_{Xi}$$

Where, $\overline{Y}$ = Geometric mean value of Y $\overline{X1}$ = geometric mean value of Xi

Here, $r = \frac{MVP}{MFC}$ where, r = Efficiency Ratio

The decision criteria are:

If r = 1, optimum/efficient utilization of resources.

If r < 1, overutilization of resources.

If r > 1, underutilization of resources

As 'r' indicates the efficiency of resource used, resources must be increased/ decreased as indicated by the percent adjustment for efficient utilization of resources.

RESULTS AND DISCUSSION

Socio-demographics

Among the respondents, 81.67% were male and 18.33% were female. Out of 60 surveyed HHs, 17 HHs (28.33%) belong to *Mallahas* followed by 16 HHs (26.67%) *Dalit* and 6 each (10%) *Rajbanshi* and *Santal*. According to DADO (2016), *Bahardar* i.e. Mallaha dominated the fish farming in Morang district but the trend is changing over time. Most of the respondents i.e. 61.66% have experience of six to twenty years. Correspondingly, the average age of the respondent was found to be 42.40 years among commercial farmers and 48.57 years among subsistence which was found to be insignificant that depicts the age of the respondents between two categories are uniform or homogeneous. The average family size of the commercial farmer was found to be 6.57 and subsistent farmer was 7.20 which were also insignificant. The average education status (in years of schooling) of the commercial farmers was found to be 7.80 and subsistent farmer was 5.87 which were also insignificant. Most of the family members belong to the agricultural background.

The flood of August 2017 havoc fish production along with pond and infrastructures in Morang district. 76.67% (36.67% commercial and 40% subsistent) were found to be affected. Many of the farmers have got the support like subsidy, trainings, monitoring, equipment, free camps and field trips. Primarily, DADO, PMAMP and NARC were found to provide support as a government bodies along with other few private agencies among the respondents.

Pond categories

The ponds were categorized into three types as production pond, nursery and hatchery. The number and average area of ponds among commercial farmers were significantly different where as insignificant in case of subsistent farmers. Average pond area was found to be 1.05 ha among commercial and 0.095 ha among subsistent farmers. There is only one subsistent farmer having own nursery and there are 3 commercial farms with their own hatchery.

Table 1. Pond type and respective area in the study area, 2018

	Commercial			Subsistent		
Type	Number	Av. area (ha)	t- value	Number	Avg. area (ha)	t- value
Production	30	1.05±0.62	8.32***	30	0.095± 0.052	0.96
Nursery	11	0.25± 0.21		1	0.034	
Hatchery	3	0.055±0.019		-	-	

**** indicates significant at 1% level*

Profitability

Cost of production

The cost of fish production per kg per year is presented in Table 2. The total cost (TC) of fish production per kg weight per year was NRs. 128.57 in commercial farms and NRs. 205.25 in subsistent farms. The total variable cost shares 60.88% percent of the total cost in commercial farm and 55.64% in subsistent farms.

Among the total cost, pond rent per year shares highest percentage i.e. 36.89% in case of commercial farm and 43.45% in subsistent farms followed by feed cost in commercial farm i.e. 27.20% and other costs in subsistent farm i.e. 26.59%. The result shows that pond rent per year, other costs are highly significant ($p<0.01$) among both farms, feed cost is moderately significant ($p<0.05$), labor, lime and fertilizer cost was obtained to be low significant ($p<0.1$). Meanwhile, depreciation cost was obtained to be insignificant i.e. both the categories of farms have uniform depreciation. In the study of Saha et al. (2004) in Bangladesh, among the different cost items, cost of feed appeared to be the highest and represented 68.70 percent of total cost of pond fish production in Mymensingh district, and in Jessore district the cost of fingerlings was highest and represented 22.72 percent of the total cost of production.

Table 2. Total cost of production per hectare of fishpond in study area, 2018

Particulars (NRs /kg)	Commercial	Subsistent	t-value
Pond Rent/ year	47.43 (23.24)	88.98 (51.19)	-4.04***
Depreciation	2.85 (2.36)	2.05 (3.01)	1.14
Total Fixed Cost (TFC)	50.28 (23.69)	91.03 (51.12)	-3.96***
Labor	15.50 (19.77)	24.87 (18.06)	-1.91*
Lime and Fertilizers	8.73 (6.19)	12.90 (10.80)	-1.83*
Feed	34.98 (25.76)	21.85 (19.56)	2.22**
Others	19.06 (7.51)	54.58 (29.85)	-6.32***
Total Variable Cost (TVC)	78.28 (42.22)	114.22 (49.66)	-3.01***
Total Cost (TC)	128.57 (43.91)	205.25 (81.80)	-4.52***

, ** and * significant at 10%, 5% and 1% level; Figures in parenthesis indicates S.D.*

Benefit and cost ratios

The undiscounted B/C ratio is simply the ratio of gross return to total cost incurred. The B/C ratio was found to be 1.87 in commercial farms and 1.33 in subsistent farms for fish farming in Morang district. The B/C ratio was found to be highly significant at 1% level. Thus, the results portray that the fish production in study area is profitable in both categories. However, commercialization and modernization of subsistent farms can provide to high return in case of fisheries enterprise.

Table 3. Cost and return analysis of commercial and subsistent fish farms in study area, 3018

Particulars in NRs /kg	Farm categories		Average	Difference
	Commercial	Subsistent		
Total Cost (TC)	128.57	205.25	166.91	-76.68
Income per kg	224.97	224.97	224.97	0
Gross Margin	146.69	110.75	128.72	35.94
Net Margin	96.41	19.72	58.065	76.94
B:C Ratio	1.87 (0.55)	1.33 (0.73)	1.60	0.54
Average Income[1]	971,879.55	701,928.79	836904.20	229950.80

[1] Average income in NRs/ ha; Figures in parentheses indicates S.D.

*t test value of B/C ratio: 3.21*** indicates significance at 1%*

Average income in the Mymensingh district of Bangladesh was found to be NRs. 567,206.00 (Tk 434,131.16) per ha with B/C ratio 1.30. But return from the fish farming is ever-growing since then. However, benefit ratio is higher in Jessore district i.e. 1.78 (Saha et al., 2004). The average cost of production of fish in Eastern Chitwan, Nepal was found to be NRs. 978,652 per ha with average return of NRs. 1,700,307. The B/C ratio so obtained was 1.74 (Sharma, 2016).

Similarly, Net Margin from fish production in a private farm in Sindh, Pakistan was obtained to be NRs. 77.02 (85 Pakistani Rupee) (Karim, Shoaib & Khwaja, 2016). The benefit-cost ratio for fish production in the in Osun State, South-Western Nigeria was found to be 1.65 (Olasunkanmi, 2012). The findings depict that the investment in fish farming is therefore worthwhile.

Production and productivity of farms

The production and productivity of the fish farms were examined. The average production of commercial fish farm per year was 4795.28 kg and 224.31 kg in subsistent farms which were found to be highly significant at 1% level. Similarly, the productivity of the farms were obtained 4.32 t/ha and 3.12 t/ha in commercial and subsistent level which is also significant at 10% level.

Table 4. Comparative production and productivity of farms in the study area, 2018

	Commercial	Subsistent	t-value
Production (kg)	4795.28 (3874.81)	224.31 (116.44)	6.45***
Productivity (ton/ha)	4.32 (2.45)	3.12 (2.75)	1.78

, * indicates significance at 10% and 1%; Figures in parentheses indicates S.D.*

The present study illustrates the higher productivity than study conducted at the zone site in 2017 i.e. 2.31 t/ha (Bista, 2017). The present finding is similar to the productivity of zone site (PM-AMP Zone Profile, 2018). The result shows that productivity in the zone implementation sites is lower than the district average i.e. 5.056 ton/ ha (DADO, 2017) and National average 4.91 t/ha (DoFD, 2017).

Production function analysis

Fish production includes use of various natural and artificial inputs/resources. Each input has certain degree of role on the determination of quantity of fish production. To determine such effect and contribution of each input in commercial and subsistent farms, in this study, extended Cobb-Douglas production function was applied and the result obtained is expressed in Table 5.

Table 5. Estimated values of the coefficients and related statistics of Cobb-Douglas production function of Fish Production

Factors	Coefficients	Std. Error	t-value
Constant	-7.629	4.923	-1.550
Type of farm (dummy)	0.731***	0.141	5.182
Labor (NRs. /ha)	0.040	0.025	1.609
Lime and fertilizer (NRs. /ha)	0.129*	0.071	1.829
Feed cost (NRs. /ha)	0.007	0.014	0.504
Other cost (NRs. /ha)	0.527***	0.107	4.911
Pond rent/year (NRS /ha)	1.055**	0.422	2.499
Depreciation (NRs/ ha)	0.026	0.020	1.329
F-value	12.581***		
R square	0.6287		
Adjusted R square	0.5787		
Return to scale	1.784		

, ** and * significant at 10%, 5% and 1% level*

Estimated coefficients values and related statistics of Cobb-Douglas production function using six explanatory variables namely labor cost, lime and fertilizer cost, feed cost, other costs, pond rent/yr and depreciation cost were considered to show their effects on production of fish. Among the six variables enlisted, lime and fertilizer cost were significant at 10% level, other cost at 1% level and pond rent per year at 5% level. The regression coefficient for lime and fertilizer cost was 0.129, which had depicted that with 100% increase in cost on lime and fertilizer, income could be increased by about 12.9%. Correspondingly, 100% increase in cost on other inputs and land rent, income could be increased by about 52.7% and 105.5%.

The coefficient of determination (R^2) was about 0.62 which means that 62% of the output is explained by the estimated model or the input considered in the function has 62% role in determining total income. The data revealed that income of commercial farms is 73.1% higher than subsistent farm which is highly significant at $p<0.01$. The F-value was found to be 12.581, which is highly significant at 1% level indicating that all the inputs included in the model were important for explaining the variation in total revenue of fish production in the study area.

Study on the fish economics conducted at Chitwan, Nepal by Sharma (2016) reported the coefficient of determination 0.615 for fish production. Correspondingly, from the study of Olasunkanmi (2012), the effects of fertilizer and labor were found to be significant at 1% ($p<0.01$) while the effects of fingerlings were significant at 5% ($p<0.05$) and R^2 was obtained to be 0.81. The present finding is significant and agrees with the findings of Olawumi et al. (2010) on homestead fish pond in Ogun State, Nigeria and Kumar and Singh (ND) in Maharajgunj district and Vanarasi in India.

Return to scale / elasticity of production

Estimation of returns to scale is important because it indicates at what scale firms are most efficient. In result, the return to scale is 1.78 which is greater than one which implies increasing return to scale i.e. increasing 100% input can increase output by 178%. This signifies that the investment on the variable input outweighs the cost of producing an additional product at an increasing rate. Similar findings was obtained from the research conducted at Southern Ghana by Asamoah et al. (2012) indicates that the fish production function representing aquaculture in the Western, Central, Volta and Greater Accra Regions of Ghana has elasticity return to scale of 1.19. The empirical regression study performed by Wagle (2016) reveals that, sum of the regression coefficients is less than unity i.e., 0.976. So, system is less efficient or 'diminishing return to scale'.

Stage of production

The result illustrates that the enterprise lies in first stage of production. It means the fishery enterprise is in the stage of higher potentiality to increase its production. In this period, each additional variable input will produce more products. A rational producer will not like to operate in this stage, because average product is continuously rising, if he stops it means he is not taking full advantage of constantly rising productivity. The firm can earn more profit by hiring more variable output and increasing his AP. So more can be earn so a rational producer wants to earn more so will not like to operate in this stage.

Resource use efficiency

Efficient use of resources is the condition when the value of the products is greater than the cost of added amount of the resource/ input used in producing it. The estimated MVP of different inputs used in fish production is presented in Table 6 for commercial farm and Table 7 for subsistent farm.

Commercial farm

The study of resource using efficiency in commercial farms revealed that ratio of MVP to MFC of the lime and fertilizer cost, other cost, pond rent/yr and depreciation cost was positive and greater than one indicating their under-utilization. Similarly, for the labor and feed cost were positive and less than one which indicated the over-utilization of these resources.

Table 6. Ratio of MVPs and MFCs of different inputs incurred in producing fish in commercial farm

Inputs (NRs/ ha)	Geometric Mean	Coefficient	MVP	MFC	MVP/MFC	Efficiency
Labor Cost	103961.0051	0.012	0.109	1.00	0.109	Overused
Lime and fertilizer cost	34668.61	0.119	3.350	1.00	3.350	Underused
Feed cost	181394.45	0.175	0.937	1.00	0.937	Overused
Other cost	74688.41	0.259	3.364	1.00	3.364	Underused
Pond rent/ year	163430.59	1.353	8.048	1.00	8.048	Underused
Depreciation	11236.47	0.073	6.313	1.00	6.313	Underused

Subsistent farm

The study of resource using efficiency in subsistent farms revealed that ratio of MVP to MFC of the labor, lime and fertilizer cost, other cost, pond rent/yr and depreciation cost was positive and greater than one indicating their under-utilization. On the other hand, for feed cost the ratio was obtained to be negative which demonstrated its over-utilization and less profit could be derived by increasing feed cost.

Table 7. Ratio of MVPs and MFCs of different inputs incurred in producing fish in subsistent farm

Inputs (NRs/ ha)	Geometric Mean	Coefficient	MVP	MFC	MVP/MFC	Efficiency
Labor Cost	58402.38	0.163	1.954	1.00	1.954	Underused
Lime and fertilizer cost	30645.03	0.148	3.380	1.00	3.380	Underused
Feed cost	77084.98	-0.001	-0.005	1.00	-0.005	Overused
Other cost	140061.42	0.491	2.459	1.00	2.459	Underused
Pond rent/ year	182590.47	0.968	3.721	1.00	3.721	Underused
Depreciation	5343.45	0.028	3.686	1.00	3.686	Underused

Overall result illustrates that all the inputs were not utilized to optimum economic advantage. Similar study conducted at Nigeria reported that none of the resources measured was efficiently used: whereas some of them were under-utilized others were over-utilized (Olasunkanmi, 2012).

CONCLUSION

The fishery enterprise was found to be profitable business in the study area. The B/C ratio was 1.87 for commercial farms and 1.33 for subsistence farms. None of the resources/ inputs was utilized to its optimum. Study on return to scale depicts that output can be significantly increased by the use of resources. Meanwhile the production and productivity of the farms in study area was comparatively lower than National average. However, reduction in use of over-utilized resources (i.e. feed and labor) and increment in proper use of underutilized resources (i.e. lime, fertilizer, other cost and pond rent) can lead the PMAMP, Zone Implementation site to achieve its objective of self-sufficiency and independency in production accompanying remunerative profit from the produce. Dependence on food import, unmanaged production activities, lack of infrastructures, and lack of technical knowhow among producers has to be addressed for farmer's struggle against economic production of fish. Thus, the fishery enterprise is in the stage of higher potentiality to increase its production in the study area.

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