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Profitability and viability study of using irrigation ponds for fish culture in Ghour Al Safi at Karak governorate in Jordan

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Abstract
Study was designed to analyze the economics of Nile Tilapia fish in irrigation pond in Jordan, as a way of determining the profitability and viability of using irrigation pond for fish production. The data were analyzed using Benefit-Cost Ratio (BCR) and Cost and Return Analysis (CRA). The results showed that an estimated average initial capital of $2579.5 was used in setting up each of the ponds farm business studied with average area 500 m^3, at a prevailing interest rate of 5.5 % /annum, and estimated average annual gross revenue of $3500 and an average net profit of $2026.1, a mean gross margin of $2392.1and a net profit margin of 68.35%, which shows that tilapia pond is a profitable business. Benefit cost ratio was estimated as 2.37, indicating that are viable enterprises. Thus, the farmers should be assisted in circumventing whatever constraints they may be facing in their production process.

Keywords: Ghour Al Safi, Irrigation Pond, Nile tilapia, Profitability, Viability

1. Introduction
Jordan is small country (8.92 million hectare) in the Middle-East between latitudes 29° 30' and 32° 31', with a total population of just 6.4 million [1, 2]. Climatically, much of Jordan can be classified as semi-desert, with only the western highlands enjoying a Mediterranean climate. Over 95% of the land area has an annual rainfall of less than 200 mm, while only 2 % has more than 350 mm. Temperatures in the Jordan Valley, Wadi Araba and Aqaba region can rise to 45°C in summer, and the mean annual temperature is 24°C. In winter, the temperature in these areas falls to a few degrees above zero, and frost is a rare event. Most precipitation falls in the form of rain. Snowfall occurs generally once or twice a year over the highlands. The rainy season extends from October to April, with the peak of precipitation taking place during January and February [3]. Fish production between (2000-2010) increased from 1075 tonnes in 2000 (7.73%) of total a viable consumption fish) to 1238.4 tonnes in 2010 (4.12%) the total a viable fish for consumption. During the same period, the capture fishes only increased by 13.3%, from 565 tonnes to 728.4 tonnes. However; during the last ten years (2000–2010), captured fishes have remained more or less static [3]. The average consumed fish per capita in Jordan during was rized from 3.60 kg/year (2004) to 4.8 kg/year (2010) and it is continuously on increase [3]. It is very low compared with other countries; it may reach to 16 kg / year. This increase quantity of imported fish is attributed to the increase in the number of commodes of people due to the large numbers of refugees and new comes to Jordan from Gulf States Fish consumption began to increase since 1992. Moreover, ten years later demand increased on Carp fish, especially after the arriving of Iraqi expatriates who like fish meal in the form of maskouf. Several restaurants cook fish, in this way were opened [3, 4]. In addition to the annual increase in the indigenous population, estimated at about 4% annually. And soaring prices of red and other white meat largely led to reluctance to purchase and the appetite for fish. Fish import bill for 2010 reached about 55.8 million. The local production contributes only by 3.6% of the total fish consumption. This means, it is possible to invest in this area to fill the shortage, especially as there are many places safe for rearing fish in Jordan, This means, it is possible to invest in this area to fill the shortage, especially as there are many places safe for rearing fish in Jordan [3, 4]. Irrigation ponds are an important source for fish production in addition to the main produced crops on the farm. Water utilization is includes its fully exploited in aquaculture and then crops irrigation. This will improve the quality of crop growth due to water containing of organic materials, feeds increase result feeding fish. A survey to count the number of ponds which can be used in fish farming showed that, they are about 5000 ponds, with an area ranging between 250 -1000 m^2 / ponds. Most of these ponds feed with water from wells existing in the region [4].

2. Materials and methods
2.1 Study Area
The study was carried out in Ghour Al Safi at karak Governorate in Jordan. It is located in the south of Ghour department of karak Governorate of Jordan. Ghour Al Safi divided into four ponds for agriculture called number 40 (249 units), 41(270 units), 42 (370 units) and 43 (118 units). This study was conducted in 1-3 July 2012 in 47 randomly selected farmers using irrigation ponds for fish culture in South Ghour (Ghour Al Safi in Karak Governorate).
Note: each Unit = 30 Dunums = 3 Hectare

2.2 Focus of the Study
This study focused on tilapia fish ponds in Ghour Al Safi area of Karak Governorate, where over 90% of the tilapia fish ponds in Karak Governorate can be found. The choice of these ponds was purposive and based on the following reasons: First, a number of irrigation ponds using for fish culture projects have been operating in these areas for many years. Secondly, over 90% of the farmers are not scientifically/

economically equipped to operate under any fiscal/ budgetary policy. Thirdly, low income and animal protein intake, which characterize of Ghour Al Safi in Karak Governorate of Jordan, increases the need to continue and intensify fish culture. In addition, there is relatively limited published information on the economics of using irrigation ponds for fish culture in most of the existing ponds.

2.3 Sampling Method
The sampling technique used for this research was the simple random sampling technique in which 47 tilapia irrigation ponds were randomly chosen in the study area. The method was chosen to ensure that every tilapia irrigation ponds in the study area was given an equal chance of selection.

2.4 Data Collection
The data were collected with the aid of well-structured sets of questionnaire, administered through personal interviews and observation so as to elicit the required information from the targeted tilapia farmers. Data were collected based on their production operations. The interviews, lasting about two to three hours, solicited information on number of years in the aquaculture business, types of operation, species cultured, product forms, marketing strategies and income generated from aquaculture. Other information collected included: characteristics of the farmer, production cycle, credit accessibility, group linkages, record keeping and access to extension services. A one pond production model was developed based on the data collected from the farmers. Such data include stocking density, management costs, feeds, harvesting cost and labour. Interviews were also conducted with farmers to identified constraints to the development of commercial aquaculture, information about markets and policies that could encourage the development of aquaculture. The instruments used for data collection were a structured questionnaire, Researchers' observation conducted in each of the farms.

2.5 Data Analysis (Analytical Technique):
The viability and profitability of catfish farmers in the study area were analyzed using:

a) Cost and Return Analysis i.e. Gross Revenue (GR) consists of receipts from total sales. It is the product of quantity harvested for sales and unit market price of fish per kilogram. Gross Revenue = Quantity Harvested (kg) X Unit Market Price, Net Profit this was determined by deducting total cost of production (TC) from the gross revenue (GR), Net Profit = Gross Revenue – Total Costs, Rate of Return on Investment (RRI) was determined by dividing net returns by total cost of production, Rate of Return on Investment = Net Returns/ Total Costs

b) Benefit-Cost Ratio (BCR)

$$\sum_{i=1}^{n} \frac{Bn}{(1+r)^n} \quad (1)$$

$$\sum_{i=1}^{n} \frac{cn}{(1+r)^n} \quad (2)$$

Where;

B_n = benefit in each year

C_n = cost in each project year

N = number of years

r` = Interest (discount) rate

3. Results & Discussion

3.1 Estimated Average Annual Investment Cost Per 500 m^3 Tilapia Fish Pond
The study showed an estimated annual mean investment outlay of $2579.5 (Table 1). This covered the cost of land $705 (27.33%), pond construction $1408.5 (54.60%), water pump $197 (7.64%), expenses on fishing net of $169 (6.55%) and other inputs such as mountainous (water pump, ponds), transportation and ect.. $100 (3.88%).

Table 1: Estimated Annual Average Investment Cost per 500 m^3 Tilapia Fish Pond.

Items	Cost ($)	% of Total Investment Cost
Land	705	27.33
Pond Construction	1408.5	54.60
Water pump	197	7.64
Fishing nets	169	6.55
Other Accessories	100	3.88
TOTAL	2579.5	100

3.2 Estimated Average Annual Operating Cost/500 m^3 Tilapia Fish Pond
As presented in Table 2, the study showed an average annual operating cost estimate of $1107.9. This cost covered feed expense of $641 (57.86%), fingerlings input expense of $316.9 (28.60%), labor cost of zero, and miscellaneous (e.g. fuel expense, transport etc.) of $150 (13.54%). where cost of feed was estimated as the largest variable cost item in tilapia production. The depreciation schedule for fixed inputs used in each of the tilapia pond unit is presented in Table 3 (below).

3.3 Estimated Annual Cost and Returns
The result of the survey showed that the farmers derived their revenue from the sale of tilapia. Estimated average Gross revenue from the sale of tilapia /500 m^3 was observed to be $3500. By deducting costs from the gross revenue, a mean net profit of $2026.1was obtained from 500 m^3 (Table 4).

Table 2: Estimated Average Annual Operating Cost

Items	Quantity	Cost ($)	Percentage of Total Operating Cost
Feed expense	700	641	57.86
Fingerling input	1500	316.9	28.60
Labor cost*	1	0	0.00
Miscellaneous	-	150	13.54
TOTAL		1107.9	100

*Cost of Labor on Vegetable Farm Not for the Fish Pond

Table 3: Depreciation Schedule for Fixed Inputs

Items	Expected Lifespan (Yrs.)	Quantity	Unit Cost ($)	Total Cost ($)	Annual Depreciation ($)
Water pump	5	1	197	197	39.4
Nets	3	1	169	169	56.3
TOTAL					95.7

Table 4: Estimated Average Annual Cost and Returns /500 m^3 Tilapia Fish Pond.

Cost and Returns	Quantity	Unit Price ($)	Cost ($)
1. Overhead (fixed costs)			
Water pump	1	197	197
Nets	1	169	169
Management (salaries)*	1	0	0
Total Fixed Cost			366
2. Operating variables			
Feed expense	700 kg	0.92 /kg	641
Fingerling input	1500 fish	0.21 / fish	316.9
Labor cost**	1	0	0
Miscellaneous	-	150	150
Total Variable Cost			1107.9
3. Total Production Cost (1+2)			1473.9
4. Gross Revenue			
Quantity of fish sold	700 kg		
Price of fish per Kg	5		
5. Gross sales of fish	3500		
6. Net Profit (5-3)	2026.1		

***** No salaries in farm: owner
**cost of labor on vegetable farm not for the fish pond

3.4 Profitability Analysis

Profitability analysis involves the determination of the total variable cost and gross revenue and determining the difference between the two. An enterprise could be adjudged profitable in the short run, if the gross revenue is greater than the total variable cost. Alternatively, the gross margin, which is the difference between the gross revenue and total variable cost, must be positive. This measurement enables investors to decide whether to invest in tilapia pond business or not. Hence, such an estimate would serve as a general guide in the choice of investment opportunity in the study area.

3.5 Viability Analysis

Viability analysis involves the determination of how viable an enterprise is, i.e how effective, the revenue covers the cost of an enterprise. It is important or necessary to determine how viable an enterprise is, since an enterprise can be profitable without being viable. The technique used in this study for the determination of enterprise viability is the Benefit-Cost Ration (BCR).

3.6 Benefit-Cost Ratio

This measure how effective, the revenue covers the cost of an enterprise. Using 5.5%, which is the interest rate on bank loans, we will have:

$$BCR = \frac{\sum_{i=1}^{n} Bn/(1+r)n}{\sum_{i=0}^{n} Cn/(1+r)n} \quad (3)$$

$$= (3500/ (1+5.5)) \div (1473.9 / (1+5.5))$$
$$= 538.46 /226.75$$
$$= 2.37$$

The estimate of 2.37 indicates that at 5.5 % discount rate, the gross revenue covered the total cost 2.37 times. This result shows that the tilapia culture in irrigation pond business in the study area is viable since BCR is greater unity.

Table 5: Gross Margin Analysis of an Average 500 m^3 Sized Tilapia Fish Pond Production in Ghour Al Safi at Karak Governorate.

Year	Variable or Operating Cost ($)	Total Revenue ($)	Gross Margin ($)	Net Profit Margin (%)
2012	1107.9	3500	2392.1	68.35

4. Conclusions

This study has shown clearly that using the Irrigation Pond for Tilapia Fish Culture in Ghour Al Safi at Karak Governorate in Jordan is profitable. All stakeholders must therefore endeavor to play their part in ensuring the survival and sustainability of the emerging Tilapia fish industry in Jordan. The high initial capital outlay could serve as a disincentive for would-be Tilapia farmers who may be resource-poor, thus resulting to fewer people engaging in Tilapia production, this will lead to low fish supply. In view of meeting the increasing demand for protein intake by filling the yawning gap between the demand and supply of fish in the region, commercial banks should be compelled by legislation to reserve a reasonable portion of their portfolios for fish farming at low interest rates. In other words, a type of selective credit policy should be adopted. This will make funds to be available to some targeted sectors of the economy, most especially aquaculture. These policies will promote borrowing and expansion of investment in commercial fish production. Effort should be made to bring down the cost of feeding which accounted for about 60% of the total variable cost of Tilapia production in the study area. Since profit is the difference between total revenue and total cost. This would directly translate to higher profit for the Tilapia farmers, a development that is healthy for the fish industry. This can be done, by exploring alternative sources of feed for Tilapia, through well-funded researches.

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