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ECONOMIC ANALYSIS OF THE PRODUCTION AND PRODUCTION COSTS OF CARP FISH FARMS IN IRAQ

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Abstract

Fish farming is the fastest growing sector in fish production, so it is seen as a major source of fish production in large quantities. Therefore, Iraq has moved towards developing fish farming, as it has a major role in investment expansion and a pillar of economic development. Environmental diversity has led to the availability of the vast water bodies in Iraq, which allow the breeding of different types of fish, lead to the success of fish farming projects in Iraq. The results of the research showed that the cost of fingerlings, pesticides and rented labor is the highest, as it constitutes 20% of the total variable costs, followed by the cost of fodder, then the costs of medicines, and finally the costs of transportation. As for the total fixed costs, the cost of renting land constitutes the highest percentage, followed by the construction of ponds and family work. The results of the research also showed that there is a big difference between the area and the optimum size of fish production, which is equal to 74 dunums of area and 693 tons of production with the actual level of area and production, which equals 46 dunams of area and 166 tons of production. So farmers must be helped to increase production that achieves economic efficiency by increasing areas through participation and union between farmers

Key words**:** *economic analysis, fish farms, fixed costs, variable costs*

INTRODUCTION

Fish is an important source of food needed to build the human body because it is one of the sources of animal protein necessary to maintain human health and safety. As fish protein is characterized by ease of digestion, absorption and assimilation compared to the protein found in red meat and poultry meat. In addition to containing fatty acids necessary for human protection. From heart and circulatory diseases [12].

Where studies and statistics have shown that the percentage of protein in fish meat ranges between 20-90% of the dry weight and 18.5% of the wet weight. as its percentage exceeds the percentage of protein in each of the beef, which is about 16.18%, and eggs, which is about 13.6%. In addition, in milk, which is about 3.8%, and this protein has a high nutritional value because it contains essential amino acids in human nutrition, as well as the containment of fish fat on high amounts of vitamins and many important minerals such as calcium, phosphorus, iodine and iron [8].

Fish farming is the fastest growing sector in fish production, so it is seen as a major source of fish production in large quantities. Therefore, Iraq has moved towards developing fish farming, as it has a major role in investment expansion and one of the pillars of economic development. And the establishment of fish farms [10].

As a result of the nutritional and economic importance, the state has been concerned with diversifying the sources of fish production and moving towards fish breeding. Therefore, fish farming began in ponds (fish farming) in the form of lakes and hatcheries in Iraq since 1954 [11].

As a result of a comprehensive development plan for the development of livestock, including the development of fisheries, by expanding the establishment of fish farms or what is related to the provision of elements of support to the elements of production.

Therefore, the number of fish farms in the beginning of the nineties reached about (13,383 farms). with a total area of (5,252 hectares). And about (18 hatcheries) with a production capacity of About (239) million fingerlings. In 2003 the number of farms increased to (1,787) farms with an area of (19,406) hectares, and the number of hatcheries increased to (25 hatcheries),

As a result of the political and economic conditions that passed through Iraq after 2003, the number of fish farms decreased (534), A farm after the world of 2006, which represents 30% of the total fish farms [7].

As for hatcheries, which are the main source for equipping fish breeders with fingerlings necessary for the fish farming process, Iraq is poor in this aspect, and reliance on imports was for most of the production elements [1].

Among the species that were used in fish production in Iraq, fish of the type of carp, where there are several types, such as the Common Carp, Grass Carp and Sliver Carp. Where this type of fish was officially, introduced to Iraq in the sixties of the last century, as it is considered a low-cost, fast-growing fish that is suitable for the Iraqi environment [2].

Although Iraq has all the capabilities that enable it to produce fish at great rates.

There is a decline in the level of production and this is due to several reasons.

The most important of which are the low volume of investments, high costs, and the suspension of government support, in addition to the large decrease in the quantities of water, the high rate of salinity and pollution in the water [3].

The research problem is the high costs of production And the farmers' failure to achieve production volumes that are close to the optimum volume of production and optimum areas, then the lowest possible production costs are achieved and profits are maximized. The research aims to study the reality of fish farm production costs, determine the optimum size for production, determine the optimum area, and compare it to the size and area actually achieved.

MATERIALS AND METHODS

Research Hypothesis

The research assumes that despite the capabilities that Iraq has in general for fish production, the quantities produced of fish are still very low because production costs are high. Therefore, it is important to estimate the production cost functions because of these indicative and economic applications of agricultural policy that can lead to Increasing production if the breeders are directed to produce according to optimum production rates and the use of optimal spaces.

Research method

Data were collected from fish farms, where we had cross-section data for the farms, and it was unloaded and analyzed using the SPSS statistical program. The sample reflected the great interest of the breeders in raising three main types of fish, at the forefront of which is (Common Carp), which forms the largest part of the fish farm owners' production, The other two types of carp (grass and silver) are produced in less quantity than the first type. From the information collected through the study sample, the breeding season for carp lasts between three to six months, during which farmers provide all production requirements such as feed, pesticides, therapeutic drugs, etc.

Data Sources

The study adopted on the collection of information from several fish production farms, in addition to the use of previous studies and research related to the subject matter of the study.

RESULTS AND DISCUSSIONS

The relative importance of variable and fixed costs for fish farms

The importance of variable costs and fixed costs for fish farms has been clarified by studying each item of these costs, as Table 1 Shows each of the variable costs that include (provender, workers' wages, medicine, water cost, fingerlings cost, transportation) and the percentage their respective contribution to total variable costs.

Table 1 Shows that the percentage of the contribution of pesticide costs, workers' wages and fingerling is the highest, Followed by the fodder, then the costs of treatment, the wages of watering, and finally the costs of transportation. The reason for the high costs of pesticides is because they are imported from outside the country. As for the high percentage of the costs of rented labor in the total variable costs, it is due to the higher labor wages. Where it needs a relatively large number of workers and because the percentage of family work is low because the breeding farms are far from the areas where the breeders live. Either as for the cost of fingerlings is high because they are the main and important factor in the production process.

As for the proportion of the relatively high cost of provender because part of the comment used is imported from the outside like Protein and soybean and other parts have high local prices such as Barley. The lack of fish diseases. As for water costs, they are due to the need to install pumps to draw water from rivers and lakes to supply farms with water. As for transportation costs, we note from Table 1 that their percentage is relatively low, due to the fact that producers sell their fish production at the farm gate, and few of them do Transfer it to the market.

Table 1 shows the items of fixed costs and the percentage of their contribution from the total fixed costs, where the table shows the high costs of renting the land because the rents are high in general.

And as for the costs of establishing ponds, they are considered fixed because they are paid once at the beginning of the establishment of the farm family work is limited to one or two people whose work is restricted to managing the work only.

Table 1. The items of variable costs, fixed costs items and their share in total costs

Items of variable costs	**Share in total variable costs, %**	**Items of fixed costs**	**Share in total fixed costs, %**
Cost of Fingerlings	70	Land Rental Cost	20
Workers' Wages	20	Family Business	3
Treatment Costs	10	Create Basins	27
Costs provender	14		
Watering Costs	10		
Pesticide Costs	20		
Transportation Costs	6		
Total	100	Total	100

Source: The table is made by the researchers based on the records of some fish farms.

Table 2 indicates that the percentage of variable costs contribution to total costs is higher than that of fixed costs, as it constitutes about 55% of total costs, while fixed costs constitute about 45% of total costs.

Therefore, the reduction of total costs will be through Minimizing variable costs.

Table 2. Contribution of variable costs and fixed costs to total costs

Cost items	Share of variable and fixed costs in total costs, %
Variable costs	55
Fixed costs	45
Total	100

Source: The table is made by the researcher based on the previous table.

Estimating the optimal size of fish farms - *Standard model estimation*

When performing the statistical analysis of the study sample data, the cubic function was adopted to calculate costs because it is significant, as this model is borrowed that meets the absence of multiple linear relationship between the independent variables (Multicollinearity) The model is non-linear in terms of variables that take the following form [4]**.**

$$TC = b_0 + b_1 Q + b_2 Q^2 + b_3 Q^3 + U$$

where:

Tc: represents the total costs of production.

Q: represents the quantity of output (tons)

Q^2: represents the square of the quantity of output (tons)

Q^3: represents cubic quantity of output (tons), U: represents the random variable.

Table 3. statistical analysis of cost data

Variable	The equation	R^2	F	$R^{/2}$	D. W.
The Cost	$TC = 27{,}671.916 + 566.7Q - 2{,}577Q^2 + 0.001Q^3$ (0.77) (1.45) (3.02)	**0.67**	**23.27**	**0.63**	**1.48**

Source: The table is made by the researcher based on records of some fish farms.
The value in parentheses indicates the calculated (t) value, (R^2) the coefficient of determination, (F) the estimated value of the model significance selection, (D. W.) Autocorrelation measurement.

Table 3 shows the existence of a self-correlation problem through the value of (D.W.) because the data used are cross-sectional data, so this problem was addressed by using the (Generalized Differences) method. This method is used to estimate the correlation coefficient ($\hat{p}$) from the estimated production function error limits, according to the Least Square Method. Where the other independent variables and the dependent variable are transformed so that the error limits of the transformed equation are not self-related, and the data transformation [5]**,** takes the following form:

$$\hat{p} = 1\text{-}d / 2$$

$$X^*t = (Xt - \hat{p}\, Xt\text{-}1)$$

$$Y^*t = (Yt - \hat{p}\, Yt\text{-}1)$$

Table 4 shows the estimated model for the regression equation after using the transformed variables to address the self-correlation problem, as the model became as presented below.

Table 4. Estimated model of the regression equation after using the transformed variables

Variable	The equation	R^2	F	$R^{/2}$	D. W.
The Cost	$TC = 18{,}956.45 + 506.667Q - 2{,}771Q^2 + 0.004Q^3$ (2.812) (-2.913) (3.417)	**.071**	**29.714**	**0.69**	**.191**

Source: The table is made by the researcher based on records of some fish farms.
The value in parentheses indicates the calculated (t) value, (R^2) the coefficient of determination, (F) the estimated value of the model significance selection, (D. W.) Autocorrelation measurement.

Table 4 shows that the parameters of the model were significant, and by comparing the calculated (**F**) value with the tabular (**F**) value, it was found that the model was highly significant, and this reflects. The importance of the variables included in the model, and the model shows through the value of the adjusted coefficient of determination (**$R^{/2}$**) that (0.69 %) of the changes in total costs are due to production, while (0.31%) of the changes in total costs were the result of other factors not included in the model.

The Durbin-Watson coefficient of the auto-correlation test was adopted in the model, which showed that there was no auto-correlation problem, as its D.W. value was about (1.91), which confirms the absence of this problem.

-Determine the optimum volume of production

To determine the optimum size for production of carp fish. The long-run average cost (LR ATC) must be known, as all production costs in the long run are considered variable, as there are no fixed costs in the long run, therefore, the average total cost can be extracted by dividing the total costs by the quantity of output after excluding the fixed term as it represents fixed costs. [9]**,** Table No. (5) Shows the estimated equation for the average total costs for fish farms, as follows:

$$LRATC = 506.667 - 2.771Q + 0.004Q^2$$

In order to determine the optimal level of production, which is determined when the average total cost in the long run reaches the lowest point, we apply the necessary condition for the minimization of the function by taking the first derivative of the function and set it equal to zero [6], as follows:

$LRATC = 506.667 - 2.771Q + 0.004Q^2 =$

-2.771+0.004 Q …….. First derivative

0.004 Q = 2.771

Q = 693

It was found that the optimum production quantity is (693) tons, which is the same as the production quantity that minimizes costs and maximizes profit. We can estimate the optimum area for a carp fish farms by entering the area as a variable in the cost function as follows:

$$TC = b_0 + b_1Q - b_2Q^2 + b_3Q^3 + b_4QA - b_5A^2$$

where:

QA: = Area in volume of production.

A^2: = Square area.

The function can estimated as shown in Table 5.

Table 5. Estimate the optimum area for carp fish farms

Variable	The equation	R^2	F	$R^{/2}$	D. W.
The Cost	TC = 157,439.502 + 438,457Q-2.804Q^2 - 5.758QA+26.908A^2 (2.407) (-2.779) (3.345) (3.442) (3.242)	**.077**	**28.064**	**0.74**	**.196**

Source: The table is made by the researcher based on records of some fish farms.
The value in parentheses indicates the calculated (t) value, (R^2) the coefficient of determination, (F) the estimated value of the model significance selection, (D. W.) Autocorrelation measurement.

Take the first derivative for (A) as follows:

= - 5.758 Q + 53.816 A

Since (Q) is known Therefore, the optimum area is as follows:

= - 3990.294+ 53.816 A

53.816A = 3990.294

A= 74

We note that the optimum area for carp fish farms, which lowers costs and maximizes profit, is (74) dunums, and when comparing the area and the optimal size for producing carp fish with the actual level of area and production, which equals (46) dunums of area and (166) tons for production, we notice that there is a big difference.

Therefore, in order to increase the production of carp fish, the area of carp farms in Iraq must expanded**.**

CONCLUSIONS

- The cost of seed, pesticides and rented labor constitutes a large proportion of the total variable costs, as it constitutes 20% for each of the total variable costs, followed by fodder, as it constitutes 14% of the total variable costs, followed by irrigation and treatment wages for each of them, 10% of the total variable costs, then costs Transportation, which constitutes 6% of the total variable costs**.**
- The high costs of renting agricultural land compared to the costs of family work and the costs of establishing breeding ponds because the rents of agricultural land are relatively high.
- The contribution ratio of the total variable costs is higher than the contribution rate of the total fixed costs, which means that the variable costs make up the bulk of the costs of fish farming.
- The farmers do not achieve the optimum volume of production nor the optimum area required to achieve that volume.

Based on the obtained results, the following recommendations were issued:

- Supporting fish producers by providing special loans to expand the areas of carp farms to increase production to meet the needs of the local market and to export the surplus abroad.
- Activating the role of the Agricultural Extension Department in the agricultural directorates in the governorates, through holding seminars and training courses for fish breeders in order to guide them about modern fish breeding methods.
- Work to increase fish production by providing all production requirements of medicines and pesticides for fish farms by the state.

- Encouraging investment in the fish production sector and encouraging individuals to adopt fish farm projects by individuals in order to increase fish production in Iraq.

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