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Economic and technical efficiency for fish framing by Data Envelopment Analysis Program

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Abstract

Fish farming is a form of aquaculture, which involves growing it in cages or ponds as an investment activity and a part of economic development. Fish production and marketing represent an interconnected and integrated system of production and marketing activities that contribute to providing animal protein, as the sequential interconnection between these activities leads to influencing each other through cost and the effectiveness of their production. This research aims to shadow light to the estimation of both technical and economic efficiency of fish farming farms two varieties (Tilapia and Buri) in Kafr el-Sheikh governorate which were cultivated by using Data Envelopment Analysis Program (DEAP). The results found that the value of the variance inflation factor was equal to 1, which means that there is no linear relationship, and the value of the coefficient of determination (R^2) was about 0.95, which means that about 95% of the changes in the quantity of fish production are due to factors reflected by the time component.

Keywords

Data Envelopment Analysis Program, Chi square, productive and marketing problems Technical and Economic efficiency.

INTRODUCTION

Fish is considered an important source of protein, and it is possible to expand the quantities produced to cover the increasing needs of animal protein; countries have recently been seeking to adopt raising the level of protein nutrition from animal sources as indicators of progress and well-being levels of people. Which necessitates to pay attention to the development of fish production as one of the modern trends to decrease the nutritional gap between production and consumption from animal protein. Fish farming represents one of the most important and good investment opportunities that can contribute to decreasing the food gap. Thus, we are interested in studying the technical and economic efficiency of fish farming, which may be reflected in the increase in income level and encourage producers to increase production in this field and continue it.

Research objective and goals

The research aims to estimate the technical and economic efficiency of fish farming as in general this includes several sub-goals, namely:

- Estimation of technical and economic efficiency of fish farming farms (Tilapia and Buri).
- Determining the amount of realized inputs for economic efficiency and estimating the losses or deficits in the inputs.
- Identifying the productive problems facing fish farming and proposals for solving them.

MATERIALS AND METHODS

Data Methodology and survey

The research relied on both descriptive and quantitative analysis methods, and some appropriate statistical methods in achieving its goals. The primary data was obtained from a questionnaire collected through a personal interview for the managers of fish farming farms in which two varieties (Tilapia and Buri) were cultivated by using Data Envelopment Analysis Program (DEAP) and chi square to obtain data from 40 farms during the early years of 2022, which can be inferred on the efficiency of fish farming production in Kafr El-Sheikh governorate. In addition to secondary sources issued by the Ministry of Agriculture and Land Reclamation, and the secretary Directorate of Agriculture, Research and References related to the subject of the research.

RESULT AND DISCUSSION

Productive parameters of fish sector in Egypt

By examining the status of fish production parameters in Egypt, it is clear from the data in Table No. (1) that: The average amount of fish production increased from about 1.44 million tons during the first period (2011-2015), which represents about 86% of the general average of about 1.67 million tons during the period (2011-2020), to about 1.9 million tons during the second period (2016-2020), Which represents about 114% of the general average during the period (2011-2020), and to demonstrate the extent to which there is a significant difference between the two study periods; A T-test was conducted between the two study periods, and its significance was proven in favor of the second period. By estimating the time trend equation for evolution quantity of fish production in exponential form the data in Table No. (2) showed that it took a general increasing trend and was statistically significant at a significance level of 0.01, with the calculated (F) value of about 183.35. The annual growth rate was about 5.1% by using Variance Inflation Factor. The average value of fish production increased from about 19.9 billion pounds during the first period (2011-2015), which represents about 57% of the general average of about 34.7 billion pounds during the period (2011-2020), to about 49.4 billion pounds during the period. The second (2016-2020), which represents about 142.5% of the general average during the period (2011-2020), and to demonstrate the extent to which there is a significant difference between the two periods of study; A T-test was conducted between the two study periods, and its significance was proven in favor of the second period. In addition, by estimating the time trend equation for the development of the value of fish production in exponential form, it was shown from the data in

Table No. (2) that it took a general increasing trend that was statistically significant at a significance level of 0.01, with the calculated (F) value of about 199.29. The annual growth rate was about 16.5%, and the value of the coefficient of determination (R2) was about 0.96, which means that about 96% of the changes in the value of fish production are due to factors reflected by time. The average quantity of fish from capture fisheries during the two study periods fluctuated around the general average of about 367 thousand tons. The average quantity of fish from natural fisheries during the first period (2011-2015), and the second period (2016-2020) is about 355,379 thousand tons, which represents about 96.7%, 103.3 of the general average during the period (2011-2020). It was shown from results that the difference between two study periods was not significantly proven. By estimating the time trend equation for the development of the quantity of fish from capture fisheries, it was shown from the data in Table No. (2) that it took a general increasing trend that was statistically significant at a significance level of 0.05, with the calculated (F) value of about 4.22. The annual growth rate was about 1.33% respectively. Thus, the value of the coefficient of determination (R^2) was about 0.34, which means that about 34% of the changes in the quantity of fish from natural fisheries are due to factors reflected by the time element. The average amount of production from fish farming (government farms - private farms - semi-intensive farming - intensive farming - aquaculture - rice field farming) all are increased from about 1.08 million tons during the first period (2011 - 2015), which represents about 83% of the general average. It amounts to about 1.3 million tons during the period (2011-2020), to about 1.5 million tons during the second period. (2016-2020), Which represents about 116% of the general average during the period (2011-2020), and to demonstrate the extent to which there is a significant difference between the two study periods; A T-test was conducted between the two study periods, and its significance was proven in favor of the second period. By estimating the time trend equation to production from fish farming in exponential form, it was shown from the data in Table No. (2) that it took a general increasing trend that was statistically significant at a significance level of 0.01, with the calculated (F) value of about 194.5. The annual growth rate was about 6.2%, and the value of the coefficient of determination (R2) was about 0.96, which means that about 96% of the changes in the amount of production from fish farming are due to factors reflected by the time impact. The average quantity of exports and imports increased from about 18.69 and 280.8 thousand tons, respectively, during the first period (2011-2015), which represents about 70% and 87% of the general average of about 26.6, 321.2 thousand tons during the period (2011-2020). It represents about 34.5, 3601 thousand tons during the second period (2016-2020), which represents about 129% and 113% of the general average during the period (2011-2020), and to demonstrate the extent of there is a significant difference between the two study periods; A T-test was conducted between the two study periods, and imports were found to be significant only related to the second period. By estimating the time trend equation for quantity of exports and imports in an exponential form, it was shown from the data in Table No. (2) that it took a general increase and statistically significant trend at a significance level of 0.01 for exports, 0.005 for imports, with the calculated (F) value of about 8.73, 4.97; the annual growth rate was about 11%, 5.5%, and the value of the coefficient of determination (R^2) was about 0.52, 0.38, which means that about 52%, 38% of the changes in the quantity of fish exports and imports are due to factors reflected by the time element. The average amount of fish consumption in Egypt (available for consumption) increased from about 1.5 million tons during the first period (2011-2015), which represents about 86% of the general average of about 1.96 million tons during the period (2011-2020),for about 2.2 million tons during the second period (2016-2020), which represents about 113% of the general average during the period (2011-2020), and to demonstrate the extent to which there is a significant difference between the two periods of the study; A T-test was conducted between the two study periods, and its significance was proven in favor of the

second period. By estimating the time trend equation for the amount of fish consumption in exponential form, it was shown from the data in Table No. (2) that it took a general increasing trend that was statistically significant at a significance level of 0.01, with the calculated (F) value of about 101.85, the annual growth rate was about 5%, and the value of the coefficient of determination (R^2) was about 0.92, which means that about 92% of the changes in the amount of fish consumed are due to factors reflected by time. It was found that the average per capita of fish in Egypt was estimated at about 21.5 kg. annually during the period (2011-2020), and this average ranged between a minimum of 19.09 kg per capita in 2011, and a maximum of 25.38 kg per capita in 2019; This is a result of the demand for fish this year, and to demonstrate the extent to which there is a significant difference between the two study periods. A T-test was conducted between the two study periods, and its significance was proven in favor of the second period. Finaly, by studying the rate of self-sufficiency in fish; It was found that the annual average reached about 85% during the period (2011-2020), with an annual deficit estimated at about 15%.

Table No.1 The quantity and value of fish production, the quantity of exports and imports, the average per capita, and the self-sufficiency rate during the period (2011-2020).

years	Total production thousand tons	Production value Million EGP	Quaintly of fish from capture fishers thousand tons	Total cultivation	Exports quantity thousand tons	Imports quantity thousand tons	Available consumption quantity	Average consumption per capita / KG/ year	Self-sufficiency rate %
2011	1362	16819	375.35	986.82	9.49	182	1534.51	19.09	88.75
2012	1372	17652	354.24	1017.74	15.81	335	1691.19	20.55	81.12
2013	1454	19629	356.86	1097.54	20.45	236	1669.55	19.73	87.1
2014	1482	22280	344.79	1137.90	28	355	1809	20.83	81.94
2015	1519	23409	344.11	1174.83	19.7	296	1795.3	20.18	84.61
Mean	1437.8	19957.8	355.07	1082.96	18.69	280.8	1699.91	20.07	84.65
2016	1706	32309	335.61	1370.66	47.81	311	1969.19	21.64	86.63
2017	1823	43811	370.96	1451.84	35.11	367	2154.89	22.72	84.61
2018	1935	48251	373.29	1561.46	26.3	324	2232.7	22.98	86.66
2019	2039	61084	397.04	1641.95	35.01	506	2509.99	25.38	81.24
2020	2010	61884	418.68	1591.89	28.13	299.74	2282.19	22.68	88.07
Mean	1902.6	49467.8	379.11	1523.56	34.47	361.54	2229.79	23.08	85.40
General Mean	1670.2	34712.8	367	1303.26	26.58	321.17	1964.85	21.57	85.03
T test	**13.35	**6.81	1.23	**21.51	2.57	*2.88	**11.08	**7.07	--

- Geometric Mean
- Available for consumption =Total quantity -Export quantity + imports quantity
- Source: Collected and calculated from data: Ministry of Agriculture and Land Reclamation, General Authority for Fisheries Development, Fisheries Statistics Annual Book, various issues.

Table No. 2 General time trend equations for quantity and value of fish production, the quantity of exports and imports, the average per capita, and the self-sufficiency rate during period (2010-2020).

VARIABLES	EQUATION	AVERAGE GROWTH RATE %	R^2	F	GENERAL MEAN
Total production (Thousand tons)	$Y=e^{7.089 + 0.0509X}$	5.1	0.96	175.28**	1599.7
Production value (Million EGP)	$Y=e^{9.3118 + 0.1601X}$	16	0.95	160.64**	29973.9
Quaintly of fish from capture fishers (Thousand tons)	$Y=e^{5.8859 + 0.00169X}$	0.16	0.89	0.79	363.7
Quantity of fish from farming (Thousand tons)	$Y=e^{6.7376 + 0.066X}$	6.6	0.97	381.8**	1236.03
Exports quantity (Thousand tons)	$Y=e^{2.293 + 0.1459X}$	14.59	0.70	19.06**	24.8
Imports quantity (Thousand tons)	$Y=e^{5.350 + 0.0681X}$	6.8	0.55	10**	316.9
Consumption quantity (Thousand tons)	$Y=e^{7.2445+ 0.05245X}$	5.24	0.94	133.69**	1891.7

Y: The estimated value of the dependent variable, **X** time variable, ** significant at 0.001 level**, * ** significant at 0.005 level, Estimate the annual growth rate with the formula that takes the form $\mathbf{Y=e^{a+bx}}$ **, means** b*100 as Percentage annual growth rate

Source: collected and calculated from the results of data analysis in Table No. (1).

Area and production of (tilapia and Buri) fish farming farms:

It was shown from table no 3 that total area of fish farming farms in Egypt is about 333 thousand feddan, varying between government farms, private farms of all types (owned, rented, and temporary), cages, and rice fields, of which Kafr El-Sheikh governorate contributes about 124.3 thousand feddan, representing 37.3% of the total fishing area at the national level. The total production of tilapia from fish farming farms in Egypt amounts to about 948.2 thousand tons, of which Kafr El-Sheikh governorate contributes about 473.9 thousand tons, representing 49.9% of the total production of tilapia from farming at the national level. The total production of Buri from fish farming farms in Egypt amounts to about 317.8 thousand tons, of which Kafr El-Sheikh governorate contributes about 113.9 thousand tons, representing 35.8% of the total production of Buri from aquaculture farming at the national level.

Table No 3 Area and production of the most important fish (tilapia and Buri) in fish farming farms in Kafr El-Sheikh Governorate in 2020.

Farm type	Area			Tilapia			Buri		
	National level	Kafr El-Sheikh Governorate	%	National level	Kafr El-Sheikh Governorate	%	National level	Kafr El-Sheikh Governorate	%
government farms (feddan)	41828	8500	20.32	12238	8010	65.45	2714	1797	66.21
private farms	48588	400683	83.73	189259	165602	87.5	40153	28394	70.71
Rented private farms	61061	7000	11.46	85737	20465	23.86	62188	8397	13.50
temporary private farms	155634	57500	36.94	574280	245334	42.72	126716	36733	28.98
Number of cages	26099	10655	40.82	86654	34469	39.77	86014	38572	44.84
Total	333210	124338	37.31	948168	473880	49.97	317785	113893	35.83

Source: Collected and calculated from data: Ministry of Agriculture and Land Reclamation, General Authority for Fisheries Development, Fisheries Statistics Annual Book,2020.

The Economic Efficiency of fish farming.

The research estimation refers to that majority of private fish farming farms in Kafr El-Sheikh governorate located in Hamul and Sidi Salem centers. A random sample was taken from 20 fish farming farms for each center during the early stages of 2022: To measure the efficiency of aquaculture farms on the sample using the Data Envelopment Analysis Program (DEAP) method. This model relies on the use of linear programming to create an envelope or field containing the data. Measuring the capacity efficiency of fish farming farms requires estimating technical efficiency according to both concepts fixed and variable return of capacity, so that the efficiency of the farms can be estimated according to the relationship of used combination resources in this field, which represents the symmetric production curve.

Estimation of technical efficiency according to the concept of fixed and variable returns.

It is assumed that fish production is affected by a set of variables, the most important of which are the cultivated area per feddan (x1), the number of Tilapia per thousand fingerlings (x2), the number of Buri per thousand fingerlings (x3), the amount of feed per ton (x4), the number of labor man/day (x6), The amount of fertilizer (x5), and the amount of water used in thousand cubic meters (x7). As shown in Table No. 4 below that farm achieved production efficiency, and these farms were characterized by a fixed yield of capacity, and they numbered 15 farms in the Hamul Center, 10 farms in Sidi Salem respectively; Thus, the actual combination used in these farms is the optimum combination that achieves the highest possible return, and this indicates that farms are working in the economic stage and must be required by other farms. It should be noted that the technical efficiency with the return on capacity both (Increasing or Decreasing), it was noted from analysis results it is about 3.7 farms return on capacity decreasing for Hamul and Sidi Salem centers in Kafr El – Sheikh governorate respectively. And therefore, it indicates that these farms can reduce the number of resources approximately used 2%, getting the same amount of production. Which means those farms are working in the second phase. While there are about 2, 3 farms with an increasing return on capacity for the two samples from the above centers, which indicates an increase in the number of resources used and obtaining a greater amount of production. These farms are working in the initial production stage as they have not reached the economic stage yet and the production elements must be intensified, Using the farm reference shown in Table No. 4 for each farm, the return on capacity will be (Decreasing, Increasing).

Table No 4 technical efficiency and return on capacity Standards for sample farms

Farm number	Fish farm area (Feddan)		Technical Efficiency (Fixed return)		Technical Efficiency (variable return)		Capacity Efficiency		Return on capacity		Reference farms	
	Hamul	Sidi Salem	Hamul	Sidi Salem	Hamul	Sidi Salem	Hamul	Sidi Salem	Hamul	Sidi Salem	Hamul	Sidi Salem
1	10	7	0.988	1.00	0.989	1.00	1.00	1.00	Fixed	Fixed	4، 2 ،19، 13 20،	1
2	7	4	1.000	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	2	2
3	11	7	1.00	0.962	1.00	1.00	1.00	0.962	Fixed	Increased	3	3
4	12	9	1.00	0.990	1.00	0.992	1.00	0.998	Fixed	Increased	4	،15 ،14 ،17 2
5	22	15	0.993	1.00	0.993	1.00	1.00	1.00	Fixed	Fixed	2، 19، 9	5
6	5	27	1.00	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	6	6
7	3	20	1.00	0.996	1.00	0.997	1.00	0.999	Fixed	Decreased	7	،8 ،17 ،6 14 ،20 ،19
8	24	33	0.997	1.00	0.999	1.00	0.998	1.00	Decreased	Fixed	2 ،19 ،20 ،9	8
9	22	50	1.00	0.993	1.00	1.00	1.00	0.993	Fixed	Decreased	9	9
10	11	32	1.00	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	10	10
11	10	40	0.929	0.992	0.976	0.997	0.952	0.995	Increased	Decreased	6 ،10 ،4 ،17	20 ،6 ،9 ،16
12	11	42	0.982	0.992	0.986	0.994	0.995	0.998	Decreased	Decreased	19 ،2 ،13 ،20	9 ،16 ،20 ،6
13	12	43	1.00	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	13	13
14	6	7	0.958	1.00	0.959	1.00	0.999	1.00	Increased	Fixed	4 ،2 ،7 ،10	14
15	15	9	0.992	0.991	0.993	1.00	1.00	0.991	Fixed	Increased	9 ،19 ،2 ،20	15
16	20	40	1.00	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	16	16
17	15	10	1.00	1.00	1.00	1.00	1.00	1.00	Fixed	Fixed	17	17
18	10	20	0.999	0.991	1.00	1.00	0.999	0.997	Decreased	Decreased	6 ،10 ،19،2	14 ،19 ،6
19	20	15	1.00	0.999	1.00	0.994	1.00	0.999	Fixed	Decreased	19	19
20	8	30	100	0.999	1.00	1.00	1.00	0.999	Fixed	Decreased	20	20
Mean	17,3	23	0.992	0.995	0.995	0.999	0.997	0.997				

Source: Results of analyzing data from the study sample in 2022.

Economic Efficiency of Fish fishering in sample survey

It was found from Table No. (5 &6) that the technical efficiency of used resources to produce tilapia and Buri in the light of resources prices and costs by using the Data Envelope Model (DEA) amounted to about 0.99%, 92% at the level of Hamul and Sidi Salem centers, respectively, while the distributional efficiency of used resources in the production of tilapia and Buri fish in light of the resources prices and costs at the central level of the sample amounted to about 92%, and this means that the redistribution of economic resources will save about 8% of the cost of producing tilapia and Buri fish. Thus, more attention must be paid to stopping waste in using available economic resources, and the availability of appropriate administrative expertise; to increase the economic efficiency of fish farming farms.

Table No 5: Economic, Technical, and Allocative efficiency estimation for sample survey.

Item	Estimation categories	Fish farm area (Feddan)	Technical Efficiency (TE)	Allocative Efficiency (AE)	Economic Efficiency (EE)
Hamul	Average	17,3	0.995	0.920	0.915
	Maximum value	24	1.00	1.00	1.00
	Minimum value	3	0.959	0.759	0.57
Sidi Salem	Average	23	0.925	0.925	0.924
	Maximum value	50	1.00	1.00	1.00
	Minimum value	4	0.925	0.735	0.731

Source: Results of analyzing data from the study sample in 2022.

Table No 6: Economic, Technical, and Allocative efficiency estimation for sample survey

Farm Number	Technical Efficiency (TE)		Allocative Efficiency (AE)		Economic Efficiency (EE)	
	Hamul	Sidi Salem	Hamul	Sidi Salem	Hamul	Sidi Salem
1	0.989	1.00	0.866	0.948	0.57	0.948
2	1.00	1.00	0.901	1.00	0.901	1.00
3	1.00	1.00	0.978	0.963	0.978	0.963
4	1.00	0.992	0.917	0.905	0.917	0.898
5	0.993	1.00	0.883	0.948	0.877	0.948
6	1.00	1.00	1.00	0.947	1.00	0.947
7	1.00	0.997	1.00	0.903	1.00	0.900
8	0.999	1.00	0.881	1.00	0.880	1.00
9	1.00	1.00	0.919	1.00	0.919	1.00
10	1.00	1.00	1.00	0.879	1.00	0.879
11	0.976	0997	0.873	0.879	0.852	0.875
12	0.986	0.994	0.848	0.898	0.836	0.893
13	1.00	1.00	0.940	1.00	0.940	1.00
14	0.959	1.00	0.943	0.966	0.905	0.966
15	0.993	1.00	0.936	0.904	0.929	0.904
16	1.00	1.00	0.907	0.974	0.907	0.974
17	1.00	1.00	0.886	1.00	0.886	1.00
18	1.00	0.994	0.759	0.735	0.759	0.731
19	1.00	1.00	1.00	0.768	1.00	0.768
20	1.00	1.00	0.957	0.878	0.957	0.878
Mean	0.995	0.925	0.920	0.925	0.915	0.924

Source: Results of analyzing data from the study sample in 2022.

Estimating the optimal use of economic resources for fish farming farms in the study sample.

Knowing the actual combinations of resources and optimal combination, which is the combination at which the symmetrical cost line touches the data envelope curve (the symmetrical production curve), since at this point of contact the economic rule for the efficient use of economic resources is achieved, as is evident from the data in Table No. (7) for indicators of economic efficiency. It was possible to compare the use of the optimal size of resources with the actual size of the same resources, as the resources under study include the cultivated area in feddan (x1), the number of tilapia fry per thousand fingerlings (x2), the number of Buri fry per thousand fingerlings (x3), and the amount of fodder in tons. (x4), the number of workers, man/day (x6), the amount of fertilizer (x5), and the amount of water used in cubic meters (x7) in exchange for the farm's fish production. For the farm to achieve full economic efficiency for the current level of total production, the number of actual resources must be adjusted according to the value of the economic efficiency index. It is clear from the data in Table No. (7) that the average total farm in the Hamoul Center needs to reduce the average cultivated area from 13 feddan to about 10.7 feddan. /Farm, and then the amount decreased in area from the size achieved for economic efficiency is amounted to about 2.3 feddan, at a rate of about 17% of the farm area used in fish production. Also, the data from the same table indicates the need to reduce the average number of tilapia fry from 209 thousand fry units/farm to about 202 thousand fry units/farm. It is also necessary to increase the number of Buri fry from 10 thousand fry units/farm to about 17.3 thousand fry units/farm by an increase. 73%, reducing average feed

quantities from 80 to about 79.4 tons of feed/farm, and reducing the number of workers increased from 422 working days/farm to 382 working days/farm, as well as a decrease in the amount of fertilizer from 29 to 25 shekels, and a decrease in the amount of water from 152 to 128 thousand meters/farm. It appears from the data in Table No. (7) that the average total of farms in the Sidi Salem center requires reducing the average cultivated area from 23 feddan to about 20.6 feddan /farm, and then the amount of decrease in area from that size achieved for economic efficiency is about 2.4 Feddan, at a rate of about 10% of the farm area is used for fish production. Data from the same above-mentioned table indicates the need to reduce the average number of tilapia fryers from 408 thousand fry units/farm to about 405 thousand fry units/farm. It is also necessary to increase the number of Buri fry from 15 thousand fry units/farm to about 17 thousand fry units/farm, and to increase the average quantities of Fodder from 157 to about 158 tons of fodder/farm, and a decrease in the number of workers from 584 days' Work/farm to 537 working days/farm, as well as a decrease in the amount of fertilizer from 53 to 46 shekels, and a decrease in the amount of water from 276 to 245 thousand meters/farm.

Table No. 7 The actual and optimum quantities of inputs that achieve economic efficiency for fish farming production in Hamul and Sedi Salem centers.

Form number	Area			Tilapia fry			Buri fry			Feed			Labor			Fertilizers			Water quantity 1000 cubic meter		
	actual	optimum	difference	actual	optimum	difference	actual	optimum	difference	actual	optimum	difference	actual	optimum	difference	actual	optimum	difference	actual	optimum	difference
Hamul	13	10.7	2.3	209	202.0	16.7	10	17.3	-6.9	80	79.4	80	422	382	40	29	25	4	152	129	23
Sidi Salem	23	20.6	2.4	408	405	3	15	17	-2	157	158	-1	584	537	47	53	46	6	276	245	31

Source: Analysis results of technical study data in 2022.

Problems and challenges facing the farming practices of the most important aquaculture fish in the study sample.

The fish farming sector suffers from deficiencies in production and marketing, which negatively affects its production and marketing efficiency. All these variables make it vulnerable to the challenges facing the expansion and development of this activity. The following is an explanation of the problems facing fish producers and marketers in fish farming in the study sample, which are represented in production and marketing problems. Since these problems have their causes, the normal distribution test is used Kolmogorov-smirnov test to know the distribution of data for a particular phenomenon whether it follows a normal distribution or not; Thus, we use non-parametric tests because the data are subject to a normal distribution, and the sample size is greater than 30; using krus;al- wallis to test and compare the distribution of 3 or more causes of the problem facing fish producers. This is to arrange the causes according to their priority and relative importance to the product, to prioritize solutions to overcome that problem, and to clarify the significance of the differences between those causes. It may result in the presence of some causes that do not have significant differences, that is, they occupy the same rank, which requires providing capabilities to solve those causes at the same time. Because of the same priority as the fish breeders, which cannot be inferred using only relative

importance. The following is an analytical presentation of the problems faced by fish producers and marketers in the study sample. Fish farmers face a set of problems that limit the use of new practices in the field of fish farming production and marketing, especially in Kafr El-Sheikh Governorate, due to the financial and human capabilities available to it in the field of fish farming that can contribute to the development of production and marketing chains.

Productivity problems:

It contains 10 reasons, as it is clear from the data in Table No. (8) that the problem of the high price of feed came first place, followed by the problem of high farm rent and the high costs of fuel used in operating machinery and mechanization, followed by the lack of quality of available water, then comes the problem of the financing wholesaler exploiting the product, the lack of sufficient liquidity, the lack of separate irrigation and drainage channels, the lack of skilled technical workers and their high wages, followed by the problem of fish being stolen during breeding and transportation, and the difficulty of procedures for obtaining loans. And finally, the high costs of disposing of dead fish and waste.

Marketing problems

It includes eight reasons for fish producers' difficulties, as is clear from the data in Table No. (9) that the problem of exploitation by traders and their high commission came in first place, followed by the problem of producers being forced to fish before the appropriate time to satisfy the financier. In addition to the above mentioned are inappropriate practices of some traders, lack of multiple forms of fish marketing, then lack of control over the price of fish, fluctuation of their prices throughout the season, decrease in the role of fish inches, then importing fish and its impact on the selling price of imported fish, low efficiency of fishing labor**.**

Table No. 8 Production problems facing fish producers from aquaculture in the sample study.

S	Problem Causes	Kolmogorov-Smirnova	Mean Rank	Ranking	Chi square
1	High farm rent.	**0.28	77.11	2	**307.89
2	High feeding from a reliable source.	**0.5	42.41	1	
3	High price of fuel.	**0.24	103.23	3	
4	lack of quality of available water.	**0.2	137.79	4	
5	Unavailability of trained workers and its high wages.	**0.16	261.99	7	
6	The financier's exploitation of the producer and the lack of sufficient liquidity	**0.2	182.99	5	
7	Difficulty in procedures for obtaining loans	**0.18	327.65	9	
8	There are no separate channels for irrigation and drainage	**0.15	256.93	6	
9	High costs of disposal of waste and dead fish	**0.25	334	10	
10	Fish are subjected to theft during breeding and transportation.	**0.16	280.91	8	

Source: Analysis results of technical study data in 2022.

Table No. 9 Marketing problems facing fish producers from aquaculture in the study sample.

S	Problem Causes	Kolmogorov-Smirnova	Mean Rank	Ranking	Chi square
1	Exploitation of traders and its high commissions.	**0.34	57.38	1	216.23**
2	Producers are forced to fish before the appropriate date to satisfy the financier	**0.24	67.96	2	
3	Lack of price control	**0.18	148.06	5	
4	Importing fish	**0.17	232.93	7	
5	Low role of fish stock	**0.19	230.19	6	
6	Low efficiency of fishing labor	**0.26	280.46	8	
7	Lack of multiple images to market fish	**0.17	136.04	4	
8	inappropriate practices of some traders	*0.14	130.99	3	

Source: Analysis results of technical study data in 2022.

CONCLUSION

Regarding farming to achieve full economic efficiency at its current level of total production, the actual resource quantity must be adjusted according to the value of the economic efficiency index. Based in results found the value of the variance inflation factor was equal to 1, which means that there is no linear relationship, and the value of the coefficient of determination (R^2) was about 0.95, which means that about 95% of the changes in the quantity of fish production are due to factors reflected by the time component. Depending upon the analysis of the problems faced by fish producers and marketers in the study sample. Fish farmers face a set of problems that limit the use of new practices in the field of fish farming production and marketing, especially in Kafr El-Sheikh Governorate, due to the financial and human capabilities available to it in the field of fish farming that can contribute to the development of production and marketing chains.

Recommendations for Facing Productivity problems are:

High price of feed came first place, followed by the problem of high farm rent and the high costs of fuel used in operating machinery and mechanization, followed by the lack of quality of available water, then comes the problem of the financing wholesaler exploiting the product, the lack of sufficient liquidity, the lack of separate irrigation and drainage channels, the lack of skilled technical workers and their high wages, followed by the problem of fish being stolen during breeding and transportation, and the difficulty of procedures for obtaining loans. And finally, the high costs of disposing of dead fish and waste.

Recommendations for Facing Marketing problems are:

Exploitation by traders and their high commission came in first place, followed by the problem of producers being forced to fish before the appropriate time to satisfy the financier. In addition to the above mentioned are inappropriate practices of some traders, lack of multiple forms of fish marketing, then lack of control over the price of fish, fluctuation of their prices throughout the season, decrease in the role of fish inches, then importing fish and its impact on the selling price of imported fish, low efficiency of fishing labor.

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