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AN ECONOMIC EFFICIENCY MEASUREMENTS ACROSS THE EGG PRODUCTION VALUE CHAINS

Ali A. Ibrahim[1*], Faten S.A. Ahmed[2], A.T.M. Hassanin[1] and A. Elghannam[3]

1. Agric. Econ. Dept., Fac. Agric., Zagazig Univ., Egypt
2. Agric. Econ. Res. Inst., Agric. Res. Cent., Egypt
3. Agric. Econ. Dept., Ext. and Rural Dev., Fac. Agric., Damanhour Univ., Egypt

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ABSTRACT: The poultry industry, especially broiler chickens, is considered as one of the most important agricultural production activities. On the one hand, it is considered one of the main sources of income in agricultural production in general and animal production in particular. On the other hand, it is considered one of the main pillars in achieving food security policy as it is an important source of protein, which is characterized by its high nutritional value, low price and high food conversion factor compared to red meat. Poultry meat occupies the third rank in terms of nutritional value after red meat, dairy products and their products. **Kame (2015)** It enjoys a high acceptance rate among Egyptian consumers, as it covers part of the nutritional gap in animal protein resulting from the shortage in red meat production. Poultry meat is considered a rich and cheap source of animal protein in Egypt compared to red meat, as the percentage of protein in poultry meat represents 31% compared to 26% of red meat, 20% of fish. The poultry sector has received many forms of government support over a long period of time, and despite that, it depends directly on importing many inputs as feed and chicks, which contributes to the rise in their production costs. **Johnston (1984)** This sector is also characterized by the lack of integration of industrial links, so that there is no structural link between these links, which leads to the presence of many factors that affect it. The monetary value of poultry meat reached about 99.32 billion pounds in 2022, which represents about 37.27%, 13.37% of the total monetary value of the animal production sector, and the total agricultural production were about 266.5,742.5 billion L.E, respectively.

Key words: Hatcheries, economic efficiency, value chains, egg production.

INTRODUCTION

Problem of the Study

The egg production sector consists of main four value chains which are: (i) the layer parent stock farms chain, (ii) the egg (layer) production farms chain, (iii) the layer hatcheries chain and (iv) the layer feed mills chain. The egg prices levels in the last period have been increased dramatically because of a lot of reasons. The main reasons can be summarized as follows : (i) the dramatic increase in layer feed prices that return to the continuous increases in prices of feed requirments such as yellow corn and protein concentrates…. etc. (ii) the relatively large numbers of layer feed mills and hatcheries have been out of services because of the production requirements are not available relatively. (iii) the layer parent stock farms is suffering from many problems such as high prices of the one-day old chicks of layer parent stock …. etc. (iv) remarkable unbalance among the inputs and outputs of the four layer value chains. **Alsawy. (2016)**

The Objective the Study

The main objectives of the study can be summarized as follow: (1) the current situation of the table eggs, layers, fertile layer egg, one day old layer chick, laying feed production in 2022 have been studied and discussed. (2) The

*** Corresponding author: Tel. :**+201094667758
E-mail address: Dr_Faten55555@yahoo.com

structures of the inputs and outputs across the Egg (layer) Production Value chains have been studied. (3) the economic efficiency measures of the four egg production value chains; (i) layer parent stock production chain, (ii) layer production chain, (iii) layer hatcheries chain and (iv) laying feed mills chain have been Estimated and investigated. (4) the profitability's and values added of one thousand table eggs through the previous four value chains have been calculating and studied. **Ragab (2019)**

Data Source and Methodology

The secondary data for Egg and Layer value chains have been collected from the ministry of agriculture. The field primary data of the quantities and prices of the inputs and outputs for the Egg and Layer value chains have been collected from four types of farms. For the layer parent stock chain, the field primary data of the quantities and prices of the inputs and outputs have been collected from El Kaheira Company for layer parent stock. For the layer chain, the field primary data of the quantities and prices of the inputs and outputs have been collected from 10 layer farms in Zagzig district. For the layer hatchery chain, the field primary data of the quantities and prices of the inputs and outputs have been collected from Masr- Ismailia Company for poultry. For the layer feed mills chain, the field primary data of the quantities and prices of the inputs and outputs have been collected from El Kaheira and fidex Companies for poultry feed.

The egg, layer parent stock, layer feed mills and hatchery farm budgets have been used to estimate: (i) the economic efficiency measures of the egg production value chains; layer parent stock production chain, layer production chain, layer hatcheries chain and layer feed mills chain and (ii) the profitability and value added of one thousand table eggs through the four studied value chains. In addition the descriptive and quantitative statistical techniques have been used to study and investigate the tendency of the table eggs, layers, fertile layer egg, one day old layer chick, laying feed production.

RESULTS AND DISCUSSION

The structure of the Egg Production Value chains

The egg production value chains are mainly consists of four chains; layer parent stock chain, layer production chain, layer feed mills chain and layer hatcheries chain. Fig. 1 indicates the structure of the Egg (layer) Production Value chains in 2022. The results in the figure indicate that: (1) the numbers of layer parent stock farms, houses, layers and hatching eggs are estimated at 44 layer farms, 271 layer houses, 1420 thousands layers and 195.5 millions fertile eggs, respectively. (2) the numbers of layer (egg) farms, houses, layers hens and table-eggs are estimated at 2987 layer farms, 46.5 million layer hens and 13.01billions fertile eggs, respectively. (3) the numbers of hatcheries, fertile eggs and one-day old chicks are estimated at 350 hatcheries, 44.3 million fertile Eggs and 38.7 millions one-day old chicks, respectively. (4) the numbers of layers feed mills and the quantity of layers feed: finishing and growing are estimated at 314 mills and 429 thousand tons: finishing feed of 258.7 thousands and growing feed of 169.9 thousands, respectively.

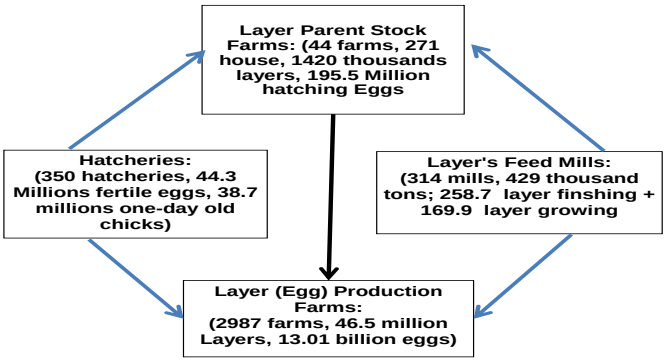

Fig. (1): The structure of the Egg (layer) Production Value chains, 2022
Source: Poultry Statistics, Economic Sector Affaires, Ministry of Agriculture, 2022.

The Current Situation of the Egg Production Value Chains

In this part of the study, the current situation of the layer parent stock, the Egg (layer), the layer hatcheries and the laying mills production Value chains in 2022 have been discussed and explained. **Hull (1980)**

The current situation of the layer parent stock Production Value chain

Number of farms

Table 1 shows the geographical distribution of egg breeder farms, with a total of about 44 farms divided into 26 farms in Lower Egypt, representing 59.9%, 14 farms in Middle Egypt, representing 31.82%, 3 farms in Upper Egypt, representing 6.82%, and one farm outside the valley. It was also found that Fayoum Governorate has the highest number of farms with about 12 farms, representing 27.27% of the total number of farms in the Republic, while Sharkia Governorate came in next place with about 11 farms, representing 25% of the total number of egg-laying farms in the Republic in 2022.

Number of sheds

Table 1 shows the geographical distribution of egg breeder farms, with a total of about 44 farms divided into 26 farms in Lower Egypt, representing 59.9%, 14 farms in Middle Egypt, representing 31.82%, 3 farms in Upper Egypt, representing 6.82%, and one farm outside the valley. It was also found that Fayoum Governorate has the highest number of farms with about 12 farms, representing 27.27% of the total number of farms in the Republic, while Sharkia Governorate came in next place with about 11 farms, representing 25% of the total number of egg-laying farms in the Republic in 2022.

Number of chickens

Table 1 shows the geographical distribution of egg breeder farms, with a total of about 44 farms divided into 26 farms in Lower Egypt, representing 59.9%, 14 farms in Middle Egypt, representing 31.82%, 3 farms in Upper Egypt, representing 6.82%, and one farm outside the valley. It was also found that Fayoum Governorate has the highest number of farms with about 12 farms, representing 27.27% of the total number of farms in the Republic, while Sharkia Governorate came in next place with about 11 farms, representing 25% of the total number of egg-laying farms in the Republic in 2022.

Numbers and types of eggs laid (million eggs) and chicks produced (million chicks) in the Arab Republic of Egypt 2022

Broiler chickens

Table 2 shows the geographical distribution of the number of eggs laid for broiler chickens with a total of 774.06 million eggs (producing 670.67 million chicks) divided into 376.61 million eggs in Lower Egypt, representing 48.65%, producing 367.86 million chicks, 119.68 million eggs in Middle Egypt, 15.46%, producing about 77.63 million chicks, and 98.6 million eggs in Upper Egypt, representing 12.74%, producing about 70.09 million chicks. Production outside the valley amounted to about 179.17 million eggs, representing 23.15% of the total production of broiler chickens of eggs in the Arab Republic of Egypt during 2022, with a production of about 155.09 million chicks. It was also found that the Nubaria region is the highest in broiler egg production, with 352.53 million eggs, representing 45.54% of the total broiler egg production at the republic level, producing about 304.95 million chicks. Sharkia Governorate came in next place with about 135.15 million eggs, representing 17.46% of the total broiler egg production at the republic level, producing about 130.69 million chicks during 2022.

Laying chickens

Table 2 shows the geographical distribution of the number of eggs laid for broiler chickens with a total of 774.06 million eggs (producing 670.67 million chicks) divided into 376.61 million eggs in Lower Egypt, representing 48.65%, producing 367.86 million chicks, 119.68 million eggs in Middle Egypt, 15.46%, producing about 77.63 million chicks, and 98.6 million eggs in Upper Egypt, representing 12.74%, producing about 70.09 million chicks. Production outside the valley amounted to about 179.17 million eggs, representing 23.15% of the total production of broiler chickens of eggs in the Arab Republic of Egypt during 2022, with a production of about 155.09 million chicks. It was also found that the Nubaria region is the highest in broiler egg production, with 352.53 million eggs, representing

Table 1. Geographical distribution of the number of farms, the number of sheds, the actual and total capacity of egg breeder farms, and the number of egg breeders in Egypt during the year 2022

Governorate	farm		Number of wards				No of chicken				Disabled power / Total (%) power
	no	%	Worked	Stopped	Total	%	actual	Disabled power	total	%	
Alexandria	3	6.82	7	0	7	2.58	45.60	4.33	49.93	3.52	8.67
Behaira	7	15.91	60	0	60	22.14	308.36	239.96	548.31	38.62	43.76
Gharbia	-		-	-			-	-	-		
Kafr-Elsheikh	-		-	-			-	-	-		
Dakahlya	-		-	-			-	-	-		
Domiatte	-		-	-			-	-	-		
Sharkia	11	25.00	75	22	97	35.79	208	224.54	432.54	30.46	51.91
Ismaeillia	1	2.27	6	3	9	3.32	26	23.08	49.08	3.46	47.03
Portsaied	-		-	-			-	-	-		
Suiz	-		-	-			-	-	-		
Monofya	1	2.27	2	3	5	1.85	12	4.83	16.83	1.19	28.70
Qalyobia	2	4.55	2	0	2	0.74	5.92	0.08	6	0.42	1.33
Cairo	1	2.27	2	3	5	1.85	17.50	0.5	18	1.27	2.78
Lower Egypt	26	59.09	154	31	185	68.27	623.37	497.33	1120.69	78.93	44.38
Giza	1	2.27	5	0	5	1.85	16.5	1.5	18	1.27	8.33
Banisuif	1	2.27	2	0	2	0.74	4.5	1.5	6	0.42	25.00
Fayoum	12	27.27	50	0	50	18.45	145.25	47.02	192.27	13.54	24.46
Menya	-		-	-			-	-	-		
Middle Egypt	14	31.82	57	0	57	21.03	166.25	50.02	216.27	15.23	23.13
Assuit	2	4.55	15	0	15	5.54	17	4.6	21.6	1.52	21.30
Sohag	1	2.27	4	2	6	2.21	17.05	4.55	21.6	1.52	21.06
Qena	-		-	-			-	-	-		
Loxour	-		-	-			-	-	-		
Aswan	-		-	-			-	-	-		
Lower Egypt	3	6.82	19	2	21	7.75	34.05	9.15	43.2	3.04	21.18
Mattroh	-		-	-			-	-	-		
Nobaria	1	2.27	8	0	8	2.95	36	3.7	39.74	2.80	9.31
North Sinai	-		-	-			-	-	-		
South Sinai	-		-	-			-	-	-		
New Valley	-		-	-			-	-	-		
Red sea	-		-	-			-	-	-		
Outer valley	1	2.27	8	0	8	2.95	36	3.74	39.74	2.80	9.41
Total	44	100.00	238	33	271	100.00	859.67	560.24	1419.91	100.00	39.46

Source: Data from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Bulletin of Livestock and Poultry Statistics, Issue 2022.

45.54% of the total broiler egg production at the republic level, producing about 304.95 million chicks. Sharkia Governorate came in next place with about 135.15 million eggs, representing 17.46% of the total broiler egg production at the republic level, producing about 130.69 million chicks during 2022.

Improved local chickens

Table 2 shows the geographical distribution of the number of eggs laid for broiler chickens with a total of 774.06 million eggs (producing 670.67 million chicks) divided into 376.61 million eggs in Lower Egypt, representing 48.65%, producing 367.86 million chicks, 119.68 million eggs in Middle Egypt, 15.46%, producing about 77.63 million chicks, and 98.6 million eggs in Upper Egypt, representing 12.74%, producing about 70.09 million chicks. Production outside the valley amounted to about 179.17 million eggs, representing 23.15% of the total production of broiler chickens of eggs in the Arab Republic of Egypt during 2022, with a production of about 155.09 million chicks. It was also found that the Nubaria region is the highest in broiler egg production, with 352.53 million eggs, representing 45.54% of the total broiler egg production at the republic level, producing about 304.95 million chicks. Sharkia Governorate came in next place with about 135.15 million eggs, representing 17.46% of the total broiler egg production at the republic level, producing about 130.69 million chicks during 2022.

The structure of inputs and Outputs items of the Egg Production Value chains

The inputs and Outputs prices and quantities items of the layer parent stock, the Egg (layer), the layer hatcheries and the laying mills production Value chains have been estimated and discussed.

The structure of the Inputs and Outputs items of the Layer Parent stock production chain

Table 3 chows the structure of the Inputs and Outputs Items of the Layer Parent Stock Production Chain. The data in the table indicate that: (1) the numbers of the layer parent stock is 8000 hens, the egg quantity per layer parent stock is 182 egg per year, the average mortality rate is around 4% and the final liveweight per spent-layer is 2.5 kg liveweight. (2) the farm-gate prices per fertile egg, per spent-layer and per manure are estimated at 12 LE/egg, 55 LE/ kg of liveweight and 600 LE/cubic meter. (3) the total return from fertile egg, from spent-layer and manure represents 93.9%, 5.9% and 0.3%, respectively. (4) the total costs for one day old chick of layer parent stock, for feeds, for other costs are estimated at 12%, 74% and 14%, respectively. (5) the total variable costs and the fixed costs represent 96% and 4% of the total costs of 8.34 million LE, respectively.

The structure of inputs and Outputs items of the Egg (Layer) production chain

Table 4 chows the structure of the Inputs and Outputs Items of the egg (Layer) Production Chain. The data in the table indicate that: (1) the numbers of the layer is 25000 hens, the egg quantity per layer is 285 egg per year, the average mortality rate is around 7% and the final liveweight per spent-layer is 2.5 kg liveweight. (2) the farm-gate prices per table egg, per spent-layer and per manure are estimated at 4.1 LE/egg, 60 LE/kg of liveweight and 500 LE/cubic meter. (3) the total return from table egg, from spent-layer and manure represents 91%, 8% and 1%, respectively. (4) the total costs for layer broiler, for layer feeds, for other costs are estimated at 5%, 83.5% and 11%, respectively. (5) the total variable costs and the fixed costs represent 95% and 5% of the total costs of 25 million LE, respectively.

The structure of inputs and Outputs items of the Layer hatchery chain

Table 5 chows the structure of the Inputs and Outputs Items of the Layer hatchery chain. The data in the table indicate that: (1) the total capacity of fertile is 1.2 million egg, the number of lots is 12 lots per year, the average hatching rate is 77.5% and the production period is 30 days per lot. (2) the farm-gate prices per one-day old layer chick is estimated at 15 LE/chick. (3) the total return from layer chicks, from infertile egg, dead chicks in shell, unfit chicks and empty plates represents97%, 3%, 2%, 2 and 0.1%, respectively. (4) the total costs for fertile egg and for other costs are estimated at 90% and 9%, respectively. (5) the total variable costs and the fixed costs represent 99% and 1% of the total costs of 11.9 million LE, respectively.

Table 2. Numbers and types of eggs laid (million eggs) and chicks produced (million chicks) in the Arab Republic of Egypt 2022

Governorate	Broiler chickens				Laying chickens				Improved local chickens			
	Laying eggs	%	chicks	%	Laying eggs	%	chicks	%	Laying eggs	%	Chicks	%
Alexandria	17.45	2.25	13.45	2.01		0.00		0.00	1.8	0.43	1.4	0.42
Behaira	5.07	0.65	37.42	5.58		0.00		0.00	1.61	0.38	1.26	0.30
Gharbia	46.14	5.96	36.71	5.47		0.00		0.00	6.99	1.66	4.26	1.01
Kafr-Elsheikh	5.3	0.68	3.89	0.58		0.00		0.00		0.00		0.00
Dakahlya	90.47	11.69	81.34	12.13		0.00		0.00	49.06	11.67	43.95	10.46
Domiatte	24.48	3.16	22.25	3.32		0.00		0.00		0.00		0.00
Sharkia	135.15	17.46	130.69	19.49	10.59	16.96	10.33	19.73	35.47	8.44	29.34	6.98
Ismaeillia	7.24	0.94	6	0.89		0.00		0.00		0.00		0.00
Portsaied		0.00		0.00		0.00		0.00		0.00		0.00
Suiz		0.00		0.00		0.00		0.00		0.00		0.00
Monofya	1.97	0.25	1.46	0.22		0.00		0.00	0.23	0.05	0.017	0.00
Qalyobia	4.5	0.58	3.78	0.56	6.12	9.80	5.14	9.81	72.38	17.22	56.92	13.54
Cairo	38.84	5.02	30.87	4.60		0.00		0.00		0.00		0.00
Lower Egypt	376.61	48.65	367.86	54.85	16.71	26.76	15.47	29.54	167.54	39.86	137.147	32.63
Giza	95.55	12.34	60.65	9.04	18.14	29.05	13.62	26.01		0.00		0.00
Banisuif		0.00		0.00	0.3	0.48	0.24	0.46		0.00		0.00
Fayoum	15.4	1.99	10.78	1.61		0.00		0.00	41.5	9.87	29.05	6.91
Menya	8.73	1.13	6.2	0.92		0.00		0.00	19.73	4.69	13.61	3.24
Middle Egypt	119.68	15.46	77.63	11.57	18.44	29.53	13.86	26.47	61.23	14.57	42.66	10.15
Assuit	3.55	0.46	2.3	0.34	0.8	1.28	0.54	1.03	4.5	1.07	3.5	0.83
Sohag	95.05	12.28	67.79	10.11		0.00		0.00	181.45	43.17	149.19	35.50
Qena		0.00		0.00		0.00		0.00		0.00		0.00
Loxour		0.00		0.00		0.00		0.00	5.55	1.32	4.72	1.12
Aswan		0.00		0.00		0.00		0.00		0.00		0.00
Lower Egypt	98.6	12.74	70.09	10.45	0.8	1.28	0.54	1.03	191.5	45.57	157.41	37.45
Mattroh		0.00		0.00		0.00		0.00		0.00		0.00
Nobaria	352.53	45.54	304.95	45.47		0.00		0.00		0.00		0.00
North Sinai	5.81	0.75	5.23	0.78	26.5	42.43	22.5	42.96		0.00		0.00
South Sinai		0.00		0.00		0.00		0.00		0.00		0.00
New Valley		0.00		0.00		0.00		0.00		0.00		0.00
Red sea		0.00		0.00		0.00		0.00		0.00		0.00
Outer valley	179.17	23.15	155.09	23.12	26.5	42.43	22.5	42.96		0.00		0.00
Total	774.06	100.00	670.67	100.00	62.45	100.00	52.37	100.00	420.27	100.00	337.217	80.24

Source: Data from the Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Livestock and Poultry Wealth Statistics Bulletin, Issue 2022.

Table 3.The structure of the Inputs and Outputs Items of the Layer Parent Stock Production Chain

Farm enterprise :	**Layer parent stock**					
No. of Layers	**8000**					
Quantity of egg/year	**182**					
Mortality rate	**4%**					
Final Liveweight	**2.5**					
Total return		**Unit**	**Quantity (egg/farm)**	**Price LE/unit**	**Value (LE/farm)**	**Percent (%)**
Main Product:						
Fertile Egg		Egg	1397760	12.00	16773120	93.8%
By-product::						
Layers		Kg	19200	55.0	1056000	5.9%
Manure		cub. M	82	600	49266	0.3%
Total revenue					17878386	100%
Variable cost:						
1- layer parent stock chick	Subtotal	No	8000	120.0	960000	12%
2- feed						
Laying Growing		Kg	3920	19.78	77538	1%
Laying 1		Kg	96600	19.43	1876938	23%
Laying 2		Kg	227920	18.45	4205124 0	50%
	subtotal		328440		6159600	74%
3-chemicals		Birds	8000	15	120000	1%
4-Vit. Care		Month	12	12000	144000	2%
5-labor		Manday	36	6000	216000	3%
6-management		Manday	1.0	20000	20000	0%
7- water & energy		LE	8000.0	8	64000	1%
8- Straw		Load	100	2000	200000	2%
Plates			46592	2.00	93184	
9-Miscellaneous		LE			16000	0%
	subtotal				873184	10%
Total Variable Cost					7992784	96%
Fixed costs:						
1- Credit		LE				
2- building		LE			3500000	
3- equipment		LE			2000000	
	subtotal				5500000	
Rent						
Depreciation		LE			223333	2.7%
Maintenance					10000	0.1%
4- family labor		Manday		6000	0	0.0%
5-interest	Years	5	interest Rate	5%	114583	1.4%
Total Fixed Costs	subtotal				347917	4.2%
Total Production Costs					8340700	100%
Gross margin		LE/farm			9,885,602	
profit/year		LE/hen			9,537,686	

Source: Compiled and calculated from the sample survey, 2022.

Table 4. The structure of the Inputs and Outputs Items of the egg (Layer) Production Chain

Farm enterprise :	**egg production**					
No. of Layers	**25000**					
Quantity of Egg/layer	**285**					
Mortality rate	**7%**					
Production period weeks	**53**					
Total return		**Unit**	**Quantity (egg/farm)**	**Price LE/unit**	**Value (LE/farm)**	**Percent (%)**
Main Product: Egg		Egg	7207500	4.10	29550750	91%
By-product::						
Layers		Kg	43013	60	2580750	8%
Manure		cub. M	600	500	300000	1%
Total revenue					32431500	100%
Variable cost:						
1- Growers (layer broiler)		No	25000	50.0	1250000	5%
2- feed						
Starting		Kg	35000	21.50	752500	3%
Growing		Kg	84000	20.50	1722000	7%
Laying 1		Kg	504000	19.70	9928800	40%
Laying 2		Kg	437500	19.40	8487500	34%
	subtotal		1060500		20890800	83%
3-chemicals (drugs)		LE	25000	10	250000	1%
4-Vaccinations		LE	25000	10	250000	1%
5-labor		Manday	90	4000	360000	1%
6-management		Manday	18.0	10000	180000	1%
7- water & energy		LE	25000.0	5	125000	0%
8- Straw		Load	200	600	120000	0%
Plates		No	240250	1.50	360375	
9-Miscellaneous		LE			30780	0%
	subtotal				1676155	7%
Total Variable Cost					23816955	95%
Fixed costs:						
1- Credit		LE				
2- building		LE			4000000	
3- equipment		LE			1500000	
	Sub-total				5500000	
Rent						
Depreciation		LE			385000	2%
Maintenance					1500	0%
4- family labor		manday		4000	0	0%
5-interest	Month	18	interest Rate	10%	825000	3%
Total Fixed Costs					1211500	4.8%
Total Production Costs/lot					25028455	100%
Gross margin/lot		LE/farm			8614545	
Gross margin/year		LE/farm			5743030	
profit/lot		LE/farm			7403045	
profit/year		LE/hen			4935363	

Source: Compiled and calculated from the sample survey, 2022.

Table 5. The inputs and Outputs items of the Layer hatchery chain

Farm enterprise	**large scale Hatchery**
Capacity (egg)	**1200000**
No of lots/years	**12**
Hatching rate	**77.5%**
Production period (days)	**30**

Total return		**Unit**	**Quantity**	**Price**	**Value**	**Percent**
			Per farm	**LE/chick**	**(LE/farm)**	**(%)**
Main Product:						
One day old chicks		No	930000	15.0	13950000	97%
By-product:						
infertile eggs		No	120000	3.80	456000	3%
dead in shell		Thousand	126000	1.75	220500	2%
unfit chicks		No	24000	11.0	264000	2%
egg plates		Plate	32000	0.25	8000	0.1%
Total revenue			1232000		14406000	100%
Variable cost:						
1- Fertile eggs		No	1200000	9.00	10800000	90%
	Subtotal			10800000		90%
3-chemicals		LE/egg	1200000	0.09	108000	1%
5-labor		LE/egg	144	5000	720000	6%
6-management		LE/egg	12.000	9000	108000	1%
7- Energy		LE/egg	1200000	0.040	48000	0%
8- requirement		LE/egg	1200000	0.09	108000	1%
9-Miscellaneous		LE				0%
	subtotal			1092000		9%
Total Variable Cost					11892000	99%
Fixed costs:						
1- Credit		LE				
2- building		LE			1250000	
3- equipment		LE			2000000	
	Sub-total			3250000		
Rent		LE				
Depreciation		LE/lot			66667	0.6%
4- spare parts		LE/lot	50000		4167	0.0%
5-interest	Year	3.0	interest Rate	5%	13542	0%
Total Fixed Costs		LE/lot			84375	0.7%
Total Costs/lot		LE/lot			11976375	100%
Gross margin/farm		LE/farm			2514000	
Gross margin/egg		LE/egg			2.10	
Gross margin/chick		LE/chick			2.70	
profit/farm		LE/lot			2429625	
profit/ egg		LE/egg			2.02	
profit/chick		LE/chick			2.61	

Source: compiled and calculated from the sample survey, 2022.

Table 5. Quantities and prices of the main feed ingredients for the layer feed

Ingredients	Laying growing	Laying 1	Laying 2	Price/ton
	Quantity (kg)	Quantity (%)	Quantity (%)	
1- Yellow corn	650	680	630.0	16050
2- Protein concentrates (10%)	100	100	100.0	18000
3- Soybean (24.5%)	245	190	180.0	21100
4- Bretix (0.2%)	2			44000
5- Toxfree (0.2%)	2			65000
6- Choline (0.1%)	1			68000
7- Calcium carbonate		30	90.0	11000
Total	1000	1000	1000	

Source: Compiled and calculated from the sample survey, 2022.

The structure of inputs and Outputs items of the Layer feed mills production chain

Table 5 chows the quantities and prices of the main feed ingredients for the layer feed**.** The data in the table indicate that the yellow corn, protein concentrates (10%) and soybean are the dominant contents for the layer feeds.

Tables 6, 7 and 8 chow the inputs and Outputs items of the Layer feed mills chain**.** The data in the tables indicate that: (i) for laying growers, the main feed costs are yellow corn (57%), protein concentrates (10%) and soybean meals (28%). (ii) for laying 1 feed, the main feed costs are yellow corn (62%), protein concentrates (10%) and soybean meals (23%). (iii) for laying 2 feed, the main feed costs are yellow corn (59%), protein concentrates (11%) and soybean meals (22%).

The economic efficiency measures of the Egg production Value chain

The economic efficiency measures of the layer parent stock, the Egg (layer), the layer hatcheries and the laying mills production Value chains have been estimated and discussed. **Abdelazim (2021).**

The economic efficiency measures of the Layer parent stock production chain

Table 9 shows the economic efficiency measures of the Layer parent stock production chain. The data shown in table indicate that: (1) the total production costs per layer parent stock and per fertile egg are estimated at 1.043 LE and 5.97 LE, respectively. (2) the gross margin per layer parent stock and per fertile egg are estimated at 1236 LE and 7.07 LE, respectively. (3) the profit per layer parent stock and per fertile egg are estimated at 1192 LE and 6.82 LE, respectively. (4) the farmer incentive, the farmer margin per fertile egg and per spent LE are estimated at 57%, 6.03 LE and 1.14 LE, respectively. (5) the total return per fertile egg, the tradable input costs per fertile egg, non-tradable input costs per fertile egg and the value added per fertile egg are estimated at 12.79 LE, 3.52 LE, 2.45 LE and 9.27 LE, respectively.

The economic efficiency measures of the Egg (Layer) production chain

Table 10 shows the economic efficiency measures of the Egg (Layer) production chain. The data shown in table indicate that: (1) the total production costs per layer parent stock and per fertile egg are estimated at 1001 LE and 3.47 LE, respectively. (2) the gross margin per layer parent stock and per fertile egg are estimated at 1236 LE and 7.07 LE, respectively. (3) the profit per layer parent stock and per fertile egg are estimated at 296.12 LE and 1.03 LE, respectively. (4) the farmer incentive, the farmer margin per fertile egg and per spent LE are estimated at 25%, 0.63 LE and 0.3 LE, respectively. (5) the total return per fertile egg, the tradable input costs per fertile egg, non-tradable input costs per fertile egg and the value added per fertile egg are estimated at 3.14 LE, 0.33 LE, and 1.36 LE, respectively.

Table 6. The inputs and Outputs items of the Layer feed mills chain: Laying Grower

Farm enterprise :	**Feed mills**				
Capacity in ton	**1000**				
Type of ration	**Layer Growing**				
Total return	**Unit**	**Quantity**	**Price**	**Value**	**Percent**
		(ton/farm)	**LE/unit**	**(LE/farm)**	**(%)**
Main Product:					
Growing feed	Ton	1000	18750.00	18750000	100%
Total revenue				18750000	100%
Variable cost:					
1- yellow corn (65%)	Ton	650	16050	10432500	57%
2- concentrate (10%)	Ton	100	18000	1800000	10%
3- soybean (24.5%)	Ton	245	21100	5169500	28%
4- Bretix (0.2%)	Ton	2	44000	88000	0%
5- Toxfree (0.2%)	Ton	2	65000	130000	1%
6- Choline (0.1%)	Ton	1	68000	68000	0%
Subtotal		1000		17688000	96%
7-labor	Month	36	5000	180000	1%
8-management	Month	2.0	12000	24000	0%
9- water & energy	Month	12.0	1500	18000	0%
10-Miscellaneous	LE	1000	20.00	20000	0%
Packages	LE	20000	4.50	90000	
	LE				0%
Subtotal				332000	2%
Total Variable Cost				18020000	98%
Fixed costs:					
1- Credit	LE				
2- building	LE			3500000	
3- equipment	LE			4550000	
Sub-total				8050000	
Rent					
Depreciation	LE			329583	1.8%
Maintenance				15000	0.08%
4- family labor	Manday		5000		0%
5-interest Month	5	interest Rate	5%		0%
Total Fixed Costs				344583	1.9%
Total Production Costs				18364583	100%
Gross margin/year	LE/farm			730000	
profit/year	LE/hen			385417	

Source: Compiled and calculated from the sample survey, 2022.

Table 7. The inputs and Outputs items of the Layer feed mills chain: Laying 1

Farm enterprise :	Feed mills					
Capacity/month in ton	2000					
Type of feed	Laying 1					
Total return		Unit	Quantity (ton/farm)	Price LE/unit	Value (LE/farm)	Percent (%)
Main Product:						
laying 1		ton	2000	17950.00	35900000	100%
Total revenue					35900000	100%
Variable cost:						
1- yellow corn (68%)		Ton	1360	16050	21828000	62%
2- concentrate (10%)		Ton	200	18000	3600000	10%
3- soybean (19%)		Ton	380	21100	8018000	23%
4- Calcium carbonate (3%)		Ton	60.00	11000	660000	2%
Sub-total			2000		34106000	97%
7-labor		month	48	5000	240000	1%
8-management		month	4.0	12000	48000	0%
9- water & energy		month	12.0	1500	18000	0%
10-Miscellaneous		LE	4000	20	80000	0%
Packages		LE	40000	5	180000	1%
		LE				0%
Sub-total					566000	2%
Total Variable Cost					34672000	99%
Fixed costs:						
1- Credit		LE				
2- building		LE			3500000	
3- equipment		LE			4550000	
Sub-total					8050000	
Rent						
Depreciation		LE			329583	1%
Maintenance					15000	0%
4- family labor		manday		5000		0%
5-interest	Month	5	interest Rate	5%		0%
Total Fixed Costs					344583	1%
Total Production Costs/month					35016583	100%
Gross margin/year		LE/farm			1228000	
profit/year		LE/hen			883417	
profit/month		LE/farm				

Source: Compiled and calculated from the sample survey, 2022.

Table 8. The inputs and Outputs items of the Layer feed mills chain: Laying 2

Farm enterprise :	**feed mills**					
Capacity/month in ton	**3000**					
Type of feed	**Laying 2**					
		Unit	**Quantity**	**Price**	**Value**	**Percent**
Total return			**(ton/farm)**	**LE/unit**	**(LE/farm)**	**(%)**
Main Product:						
laying 2		ton	3000	17650.00	52950000	100%
Total revenue					52950000	100%
Variable cost:						
1- yellow corn (63%)		Ton	1890	16050	30334500	59%
2- concentrate (10%)		Ton	300	18000	5400000	11%
3- soybean (18%)		Ton	540	21100	11394000	22%
4- Calcium carbonate (9%)		Ton	270	11000	2970000	6%
Sub-total			3000		50098500	98%
7-labor		month	72	5000	360000	1%
8-management		month	6.0	12000	72000	0%
9- water & energy		month	12.0	1500	18000	0%
10-Miscellaneous		LE	3000	20	60000	0%
Packages		LE	60000	4.5	270000	1%
Sub-total		LE				0%
					780000	2%
Total Variable Cost					50878500	99%
Fixed costs:						
1- Credit		LE				
2- building		LE			3500000	
3- equipment		LE			4550000	
Sub-total					8050000	
Rent						
Depreciation		LE			329583	1%
Maintenance					1000	0%
4- family labor		manday		5000		0%
5-interest	Month	5	interest Rate	5%		0%
Total Fixed Costs					330583	1%
Total Production Costs/month					51209083	100%
Gross margin/year		LE/farm			2851500	
profit/year		LE/hen			1740917	

Source: Compiled and calculated from the sample survey, 2022.

Table 9. The economic efficiency measures of the Layer parent stock production chain

Economic Efficiency Measures	Unit	Values
Total Production Costs / year	LE	8,340,700
Total production Costs / layer	LE	1,043
Total Costs / fertile egg	LE	5.97
Gross margin/year	LE	9,885,602
Gross margin/layer	LE	1,236
Gross margin/fertile egg	LE	7.07
profit/year	LE	9,537,686
profit/ layer	LE	1,192.21
profit/fertile egg	LE	6.82
profit/LE	LE	1.14
farmer incentive	%	57%
Farmer margin/fertile egg	LE	6.03
total return/fertile egg	LE	12.79
Tradable input costs/fertile egg	LE	3.52
Non-tradable input costs/ fertile egg	LE	2.45
total production costs/fertile egg	LE	5.97
Value added/fertile egg	LE	9.27

Source: compiled and calculated from Table (5).

Table 10. The economic efficiency measures of the Egg (Layer) production chain

Measures	Unit	Values
Price of egg	LE	4.10
Feed Costs	%	83.5%
Fixed Costs	%	4.8%
Variable Costs	%	95.2%
Total production Costs / lot	LE	25028455
Total Production Costs / year	LE	16685637
Total production Costs / layer	LE	1001
Total Costs / egg	LE	3.47
Gross margin/layer	LE	345
Gross margin/egg	LE	1.20
profit/ layer	LE	296.12
profit/egg	LE	1.03
profit/LE	LE	0.30
farmer incentive	%	25%
Farmer margin/ egg	LE	0.63
total return/egg	LE	4.50
Traded input costs/egg	LE	3.14
Non-traded input costs/egg	LE	0.33
total production costs/egg	LE	3.47
Value added/egg	LE	1.36
Value added/layer	LE	392

Source: Compiled and calculated from Table (6).

The economic efficiency measures of the Layer hatcheries chain

Table 11 shows the economic efficiency measures of the Layer hatchery chain. The data shown in table indicate that: (1) the total production costs per egg and per hatched chick are estimated at 9.98 LE and 12.88 LE, respectively. (2) the gross margin per egg and per hatched chick are estimated at 2.1 LE and 2.07 LE, respectively. (3) the profit per egg and per hatched chick are estimated at 2.02 LE and 2.61 LE, respectively. (4) the farmer incentive, and the farmer margin per hatched chick are estimated at 17%, 2.12 LE, respectively. (5) the total return per hatched chick, the tradable input costs per hatched chick, non-tradable input costs per hatched chick, the value added per hatched chick and hatched egg are estimated at 15.49 LE, 5.87 LE, 7.011 LE, 9.62 L.E/ton and 7.46 L.E/ ton, respectively.

The economic efficiency measures of the Layer feed mills production chain

Laying grower feed

Table (12) shows the economic efficiency measures of feed mills chain: laying grower. The data shown in table indicate that: (1) the total production costs per ton is estimated at 18365 LE. (2) the gross margin per ton is estimated at730 LE. (3) the profit per ton is estimated at 385.42 LE, respectively. (4) the farmer incentive, and the farmer margin ton are estimated at 2.1% and 385.42 LE, respectively. (5) the total return per ton, the tradable input costs per ton, non-tradable input costs per ton and the value added per ton are estimated at 18750 LE, 17688 LE, 676.58 LE, and 1062 L.E respectively.

Laying I feed

Table 13 shows the economic efficiency measures of the Layer feed mills chain: laying 1. The data shown in table indicate that: (1) the total production costs per ton is estimated at 117508 LE. (2) the gross margin per ton is estimated at 614 LE. (3) the profit per ton is estimated at 441.71 LE, respectively. (4) the farmer incentive, and the farmer margin ton are estimated at 2.5% and 441.71 LE, respectively. (5) the total return per ton, the tradable input costs per ton, non-tradable input costs per ton and the value added per ton are estimated at 17950 LE, 455.29 LE, 897 LE, and 1062 L.E, respectively.

Laying II feed

Table 14 shows the economic efficiency measures of the Layer feed mills chain: laying 2. The data shown in table indicate that: (1) the total production costs per ton is estimated at 17070 LE. (2) the gross margin per ton is estimated at 950.5 LE. (3) the profit per ton is estimated at 580.31`LE, respectively. (4) the farmer incentive, and the farmer margin ton are estimated at 3.3% and 580.31 LE, respectively. (5) the total return per ton, the tradable input costs per ton, non-tradable input costs per ton and the value added per ton are estimated at 17650 LE, 16700 LE, 370.19 LE, and 950.5 L.E, respectively.

The total production per one day old layer parent stock chick across the four studied value chains

In this part of the study the total production per one day old chick of layer parent stock across the four studied value chains have been estimated and investigated. The estimation of the total production per one day old chick for layer parent stock across the four studied value chains are presented in figure (2). The total production per one day old chick for layer parent stock can be summarized as follows: (1) in layer parent stock farms, (i) the one day old chick consumed 59 kg of feed; almost 1% of starting feed, 8% of growing feed and 91% laying feed, (ii) the mortality rate is estimated at 4% and the egg rate is estimated at 185 fertile egg per layer. (2) In hatcheries chain, the hatching rate is estimated at 80%, consequently the numbers of one day old for layer chick is estimated at 140 chicks. (3) In egg (layer) production farms, (i) the one day old chick consumed 59 kg of feed. In total the 140 chicks consumed around 8247 kg of feed; 1649 kg of starting feed, 2474 kg of growing feed and 4123 kg of laying feed, (ii) the mortality rate is estimated at 7% and the egg rate is estimated at 285table egg per layer. Consequently the total egg production is estimated at 37107 table eggs.

The Profitability and Value Added per 1000 Table Egg Across the Four Layer Value Chains

The total profits and values added per 1000 table eggs produced across the main four layer value chains are presented in Table (15). The results in the table indicate that (i) the total profits for the four value chains are estimated at 1142 LE; 90% for layer value chain and 9% for

Table 11. The economic efficiency measures of the Layer hatchery chain

Measures	Unit	Values
Hatchability	%	77.5%
Price of one day old chick	LE	15.0
Total Production Costs / farm	LE	11976375
Total production Costs / egg	LE	9.98
Total Production Costs / hatched chick	LE	12.88
Gross margin	LE	2514000
Gross margin/ egg	LE	2.10
Gross margin/ hatched chick	LE	2.70
profit/farm	LE	2429625
profit/ egg	LE	2.02
profit/chick	LE	2.61
profit/LE	LE	0.20
farmer incentive	%	17%
Farmer Margin/hatched chick		2.12
Total return/ hatched chick	LE/ton	15.49
Total return/ egg		12.01
traded input costs per hatched chick	LE/ton	5.87
non-traded input costs per hatched chick	LE/ton	7.011
traded input costs per egg		4.55
non-traded input costs per egg		5.43
Value added of hatched chick	LE/ton	9.62
Value added of hatched egg	LE/ton	7.46

Source: Compiled and calculated from Table (7).

Table 12. The economic efficiency measures of the Layer feed mills chain: laying grower

Price of ton	LE	18750.00
Total production Costs	LE	18364583
Total Production Costs / ton	LE	18365
Gross margin	LE	730000
Gross margin/ton	LE	730.00
profit/ year		385416.67
profit/ ton	LE	385.42
profit/LE	LE	0.02
farmer incentive	%	2.1%
Farmer margin/ ton	LE	385.42
total return/ton	LE	18750.00
Traded input costs/ton	LE	17688
Non-traded input costs/ton	LE	676.58
Value added/ton	LE	1062.00

Source: Compiled and calculated from table (9).

Table 13. The economic efficiency measures of the Layer feed mills chain: laying 1

Economic Efficiency Measures	Unit	Values
Price of ton	LE	17950.00
Total production Costs / month	LE	35016583
Total Production Costs / ton	LE	17508
Gross margin/year		1228000
Gross margin/ton	LE	614.00
profit/year		883416.67
profit/ ton	LE	441.71
profit/LE	LE	0.03
farmer incentive	%	2.5%
Farmer margin/ ton	LE	441.71
total return/ton	LE	17950.00
Traded input costs/ton	LE	17053
Non-traded input costs/ton	LE	455.29
Value added/ton	LE	897.00

Source: Compiled and calculated from Table (10).

Table (14): The economic efficiency measures of the Layer feed mills chain: laying 2

Measures	Unit	Values
Price of ton	LE	17650.00
Total production Costs	LE	51209083
Total Production Costs / ton	LE	17070
Gross margin	LE	2851500
Gross margin/ton	LE	950.50
profit/year		1740916.67
profit/ ton	LE	580.31
profit/LE	LE	0.03
farmer incentive	%	3.3%
Farmer margin/ ton	LE	580.31
total return/ton	LE	17650.00
Traded input costs/ton	LE	16700
Non-traded input costs/ton	LE	370.19
Value added/ton	LE	950.50

Source: Compiled and calculated from Table (11).

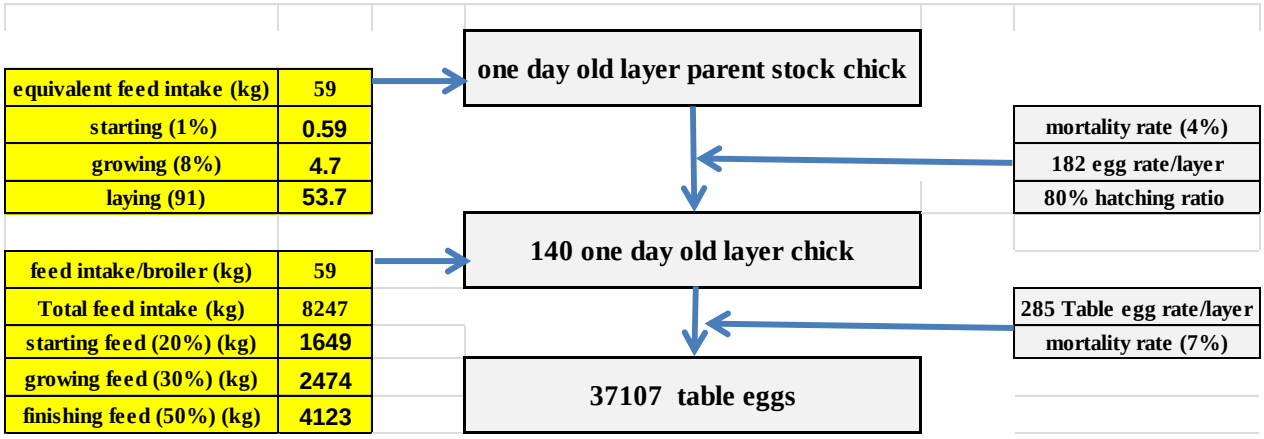

Fig. 2. The total production per one day old layer parent stock chick across the four studied value chains

Source: Compiled and calculated from the Tables (5-11).

Table 15. The profit and value added per 1000 table eggs

Value chain	Unit	Production	Profit /unit	Total profit	%	Value added / unit	Total value added	%
layer parent stock	One day old chicks of parent stock	0.03	6.82	0.2046	0.02%	9.27	0.2781	0.02%
Hatchery	One day old chicks of layer	3.49	2.61	9.1089	0.80%	9.62	33.5738	2.11%
feed mills	Ten	0.206	501.625	103.335	9.04%	951.25	195.958	12.33%
layer	table egg	1000	1.03	1030	90.14%	1.36	1360	85.54%
Total				1142.65	100.00%		1589.81	100.00%

Source: Compiled and calculated from the Tables (5-17).

feed mills value chain. (ii) the total values add for the four value chains are estimated at 1589.8 LE; 85.5% for layer value chain, 12.3% for feed mills value chain and 2.1% for the hatchery value chain.

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علي احمد ابراهيم[1] - فاتن سمير أبو اليزيد أحمد[2] - علي طاهر حسانين[1] - أحمد عادل الغنام[3]

1- قسم الاقتصاد الزراعي - كلية الزراعة – جامعة الزقازيق – مصر

2- معهد بحوث الاقتصاد الزراعي – مركز البحوث الزراعية – مصر

3- قسم الاقتصاد والارشاد الزراعي والتنمية الريفية- كلية الزراعة- جامعة دمنهور – مصر

تعتبر صناعة الدواجن وخاصة الدجاج اللاحم من أهم أنشطة الإنتاج الزراعي، فهي من ناحية تعتبر من أهم مصادر الدخل في الإنتاج الزراعي بشكل عام والإنتاج الحيواني بشكل خاص، ومن ناحية أخرى تعتبر من الركائز الأساسية في تحقيق سياسة الأمن الغذائي حيث أنها مصدر مهم للبروتين الذي يتميز بقيمته الغذائية العالية وسعره المنخفض ومعامل التحويل الغذائي العالي مقارنة باللحوم الحمراء. ونظرا لارتفاع مستويات أسعار البيض في الفترة الأخيرة بشكل كبير لأسباب عديدة، فتتلخص مشكلة الدراسة في الارتفاع الكبير في أسعار أعلاف الدجاج البياض والذي يعود إلى الزيادات المستمرة في أسعار متطلبات الأعلاف مثل الذرة الصفراء ومركزات البروتين... إلخ. وايضا خروج أعداد كبيرة نسبيًا من مصانع أعلاف الدجاج البياض والمفرخات عن الخدمة بسبب عدم توفر متطلبات الإنتاج نسبيًا. كما تعاني مزارع الدجاج البياض من العديد من المشاكل مثل ارتفاع أسعار الكتاكيت التي يبلغ عمرها يومًا واحدًا من مخزون الدجاج البياض... إلخ. وكذلك عدم التوازن الملحوظ بين المدخلات والمخرجات لسلاسل القيمة الأربع للدجاج البياض. واستهدفت الدراسة مناقشة الوضع الحالي لإنتاج بيض المائدة والبياض وبيض البياض المخصب وكتاكيت البياض بعمر يوم واحد وأعلاف البياض في عام 2022. واعتمدت الدراسة علي هياكل المدخلات والمخرجات عبر سلاسل قيمة إنتاج البيض (البياض) وتقدير مقاييس الكفاءة الاقتصادية لسلاسل قيمة إنتاج البيض الأربعة؛ (i) سلسلة إنتاج مخزون أمهات البياض، (ii) سلسلة إنتاج البياض، (iii) سلسلة مفرخات البياض و(iv) سلسلة مطاحن أعلاف البياض. تم جمع البيانات الثانوية لسلاسل قيمة البيض والبياض من وزارة الزراعة. تم جمع البيانات الأولية الميدانية لكميات وأسعار المدخلات والمخرجات لسلاسل قيمة البيض والبياض من أربعة أنواع من المزارع. بالنسبة لسلسلة أمهات الدجاج البياض، تم جمع البيانات الأولية الميدانية لكميات وأسعار المدخلات والمخرجات من شركة القاهرة لأمهات الدجاج البياض. بالنسبة لسلسلة البياض، تم جمع البيانات الأولية الميدانية لكميات وأسعار المدخلات والمخرجات من 10 مزارع بياض في منطقة الزقازيق. بالنسبة لسلسلة مفرخات الدجاج البياض، تم جمع البيانات الأولية الميدانية لكميات وأسعار المدخلات والمخرجات من شركة مصر / الإسماعيلية للدواجن. بالنسبة لسلسلة مصانع أعلاف البياض، تم جمع البيانات الأولية الميدانية لكميات وأسعار المدخلات والمخرجات من شركتي القاهرة وفيدكس لأعلاف الدواجن. تم استخدام ميزانيات البيض وأمهات الدجاج البياض ومصانع أعلاف البياض ومزارع المفرخات لتقدير: (أ) مقاييس الكفاءة الاقتصادية لسلاسل قيمة إنتاج البيض؛ سلسلة إنتاج أمهات الدجاج البياض، وسلسلة إنتاج البياض، وسلسلة مفرخات البياض، وسلسلة مصانع أعلاف البياض و(ب) الربحية والقيمة المضافة لألف بيضة مائدة من خلال سلاسل القيمة الأربع المدروسة. بالإضافة إلى ذلك تم استخدام الأساليب الإحصائية الوصفية والكمية لدراسة والتحقيق في اتجاه إنتاج بيض المائدة والبيض البياض والبيض البياض المخصب وكتاكيت البياض عمر يوم واحد وأعلاف البياض.

الكلمات الإسترشادية: المفرخات، الكفاءة الاقتصادية، سلاسل القيمة، انتاج البيض.

المحكمـــــون:

1- أ.د. عبدالمنعم السيد عبدالفتاح ضيف رئيس بحوث متفرغ - معهد بحوث الإقتصاد الزراعي - مركز البحوث الزراعية.

2- أ.د. أنـــور علـــى مرســـي لبـــن أستاذ الإقتصاد الزراعي - كلية الزراعة - جامعة الزقازيق.