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Estimating the Productive and Economic Efficiency of Broiler Chicken Farms in Egypt: (Case Study in Gharbia Governorate)

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Abstract: The poultry production sector is considered one of the important sectors in the field of animal production in particular and in the field of agriculture in general, as it is one of the most important sources of animal protein production, represented by the production of meat and eggs. The value of poultry production is estimated at about 55.9 billion pounds, representing about 29.8% of the total value of animal production for the year. 2019, the research problem is the low production and economic efficiency of broiler farms. The research aims to study the possibility of achieving technical, economic and distribution efficiency for each of the sample capacities: the first capacity (3000 chicks and less), the second capacity (more than 3000 chicks - 6000), the third capacity (more than 6000 chicks), The most important results reached by the research regarding the analysis of the components of production costs per thousand chicks and regarding production per ton in broiler farms for different production capacities in the study sample in Gharbia Governorate. It became clear that the highest percentage in the cost of total production requirements was in the third (capacity), followed by the second and finally the first, the highest percentage in the total costs were in the first (capacity), followed by the second and finally the third alike. The economic evaluation of the production of a thousand chicks and with regard to the production of a ton in broiler farms for different production capacities in the study sample in Gharbia Governorate showed that the highest net return was in the third (capacity), followed by the first and finally the second, and that the highest profitability was in the third (capacity) followed by the first and finally the second, as a result The highest net return (capacity) was in the third, followed by the first and finally the second. The highest return on the invested pound was in the third (capacity), followed by the first and finally the second. As a result of the high net return in (capacity), the third, followed by the first and finally the second, the highest percentage of return on costs was in the third (capacity). It is followed by the first and finally the second, as a result of the decrease in the total costs of the third capacity, followed by the first and finally the second, The economic evaluation of the production of a thousand chicks and with regard to the production of a ton in broiler farms for different production capacities in the study sample in Gharbia Governorate showed that the highest net return was in the third (capacity), followed by the first and finally the second, and that the highest profitability was in the third (capacity) followed by the first and finally the second, as a result The highest net return (capacity) was in the third, followed by the first and finally the second. The highest return on the invested pound was in the third (capacity), followed by the first and finally the second. As a result of the high net return in (capacity), the third, followed by the first and finally the second, the highest percentage of return on costs was in the third (capacity). It is followed by the first and finally the second, as a result of the decrease in the total costs of the third capacity, followed by the first and finally the second, it has also been shown that there has been a waste of the quantities of resources used in the production process for the three production capacities. Therefore, in order for the farm to achieve full economic efficiency at the current level, the amount of actual resources must be reduced according to the value of the economic efficiency index, and to achieve the optimal volume of production for the three production capacities, costs must be reduced. Total production amounts to 21.2%, 13.7%, and 25% of the costs of the resources currently used.

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Introduction:

Livestock production is considered one of the most important productive activities in the Egyptian agricultural sector, because it represents a major role as one of the sources of income in the agricultural sector, as the value of livestock production amounted to about 187.4 billion pounds, representing 35.1% of the total value of agricultural production, which amounts to about 354.2 billion [(15)]pounds in Egypt. In 2019, the poultry production sector is considered one of the important sectors in the field of animal production in particular and in the field of agriculture in general, as it is one of the most important sources of animal protein production, represented by the production of meat and eggs. The value of poultry production is estimated at 55.9 billion [(15)] pounds, representing about 29.8%. Of the total value of animal production for the same year, the number of farms producing meat chickens in 2022 reached about 21.96 thousand farms containing 29.53 thousand [(18)] dormitories, representing 87.9% of them activated dormitories and the rest deactivated dormitories. The poultry production sector is characterized by its economic and nutritional importance, as poultry is a source of it is important for income for producers of white meat and eggs. It is also one of the basic pillars for achieving food security at the national level. It is an important source of human food as it contains the animal protein necessary to build the human body. Poultry is characterized by its high nutritional value because it contains amino acids, fats, and mineral salts. The poultry industry is distinguished by its high nutritional value. It has many characteristics, the most important of which are its short fattening period, rapid capital turnover, high liquidation rate, high food conversion factor, and the provision of many job opportunities, in addition to not requiring a large agricultural area or expensive feed compared to red meat. Many other industries are also linked to this industry, such as the animal feed industry, medicines, veterinary supplies, etc. This indicates that the production of broiler chickens is considered one of the activities that deserve more care and attention so that its contribution to the value of animal production can be increased.

Research problem:

The poultry industry in Egypt is facing a decline in the actual production capacity of broiler farms below the maximum operating capacity, as the actual capacity reached about 61% [(18)] of the full capacity in 2022 as a result of the significant increase in the costs of production requirements, especially the increase in fodder costs and the purchase prices of chicks, in addition to many risks to which it is exposed. This sector is affected by diseases, epidemics, and great sensitivity to climate changes and fluctuations, which may affect production on farms. This led to the reluctance of many investors and small breeders, who constitute about 75% [(15)] of the volume of investment in the poultry sector, to work in this sector This may conflict with national food security policies as a result of the decline in white meat productivity and the recent steady increase in population numbers, which increases the size of the problem. Therefore, the problem of the research is the decline in the productive and economic efficiency of broiler farms. This requires answering the following question: Do broiler farms achieve productive and economic efficiency in Gharbia Governorate, as it is one of the most important governorates in producing broiler chickens in Egypt? Do these farms exploit their resources efficiently, and what is the optimal combination of resources that achieves efficiency, and which of these farms is the most efficient?

Research goal:

The research aims to study the possibility of achieving productive and economic efficiency for each of the three sample capacities in Gharbia Governorate. As a main objective, through a set of sub-objectives limited to:

First: The current status of broiler farm production in Egypt and Gharbia Governorate.

Second: Estimating time series models for the production of broiler chicken farms in Egypt and Gharbia Governorate.

Third: Analysis of the components of production costs per thousand chicks in broiler farms for different production capacities in the study sample in Gharbia Governorate.

Fourth: Analysis of the components of production costs for producing a ton of broiler chicken for different production capacities in the study sample in Gharbia Governorate.

Fifth: Economic evaluation of the production of broiler chicken farms for different production capacities in the study sample in Gharbia Governorate.

Sixth: Estimating and measuring the efficiency of resources used in producing broiler chickens.

Seventh: Technological efficiency and capacity efficiency of meat poultry in Gharbia Governorate.

Eighth: Distribution efficiency, production efficiency, and costs for broiler chickens in Gharbia Governorate.

Research Method and data sources:

To achieve the goal of the research, descriptive and quantitative statistical analysis methods were applied, such as simple statistical methods such as percentages and arithmetic averages related to broiler farms through time series data during the period (2000-2022), in addition to using some economic and statistical methods and models, To arrive at an

estimate for time series models with a good ability to predict the values of each of the research variables in the following years, such as using the Augmented Dickey-Fuller Unit Root Test to determine the extent to which the series is stable or not, then estimate the parameters of the time series model. Using the model (1 ARI term), and Thiel's inequality coefficient, The Data Envelopment Analysis Program (DEAP) was also used to estimate Technological Efficiency (TE) and Economic Efficiency (EE), determine the amount of resources achieved for economic efficiency, and thus estimate the surplus or deficit in economic resources used in broiler production farms [(13)]. And studying the difference between the average actual quantities of resources used, and the optimal quantities achieved for economic efficiency. The research relied on published and unpublished data available in economic and statistical bulletins issued by the Ministry of Agriculture and Land Reclamation [(17)], as well as the Directorate of Agriculture in Gharbia Governorate [(20)]. In achieving its objectives, the research also relied on field data that was provided using a questionnaire during the 2023 season for the sample. Random stratification of 50 representative farms of broiler chicken production farms in Gharbia Governorate.

Selecting a sample of broiler production farms and determining its size and distribution:

The districts of Mahalla al-Kubra and Zefta in the Gharbia governorate were chosen for their relative importance in production, as these two districts represent about 41.6% of the total number of wards operating in the governorate, which numbers about 2853 dormitories. The villages of Al-Hayatem and Danusher in the Mahalla Al-Kubra district were also chosen for their relative importance, as they together represent about 11% of the total operating dormitories at the district level, which amounts to about 606 dormitories. The villages of Sindbast and Kafr Sinbat in the Zefta district were also chosen for their relative importance, as they together represent about 13.85% of the total operating dormitories in the district, which amounts to about 582 dormitories. Then the sample size was determined by the law $C.V= \sigma/ \bar{x}.\sqrt{n}$ Where, C.V (coefficient of variation) = ranges between 0.01, 0.1= 0.05 hypothetically, σ = 0.318 from previous studies, $\bar{x}$ = the total number of working dormitories/The number of breeders represents about 0.90 dormitories.

Thus, the sample size was about 50 observations. The study sample was distributed among the two centers mentioned, by multiplying the total sample by the adjusted geometric mean for each district, so the Mahalla El-Kubra Center's share of the number of observations selected from the sample was about 26 observations, and the Zefta district's share was about 24 observations. The sampling fraction for the district of Mahalla al-Kubra was also determined and was approximately 1/3.35, while the sampling fraction for Zefta district amounted to about 1/2.83. The study sample was distributed among the selected sample villages in each center by multiplying the total number of breeders for broiler production in the village by the sampling fraction. The share of the villages of Al-Hayatem and Danusher in the center of Mahalla was about 13.13 views, respectively, while the share of the villages of Sindbast and Kafr Sinbat in the center of Zefta was about 13 ،11 views. The farms were divided into three holding capacities, the first capacity (3000 chicks or less) representing 14. Viewings, the second capacity (more than 3000-6000 chicks) represents 22 views, and the third capacity (more than 6000 chicks) represents 14 views.

Results:

First: The current status of broiler farm production in Egypt and Gharbia Governorate:

The current status of broiler farm production in Egypt and Gharbia Governorate shows the development of the number of broiler farms, the number of activated and deactivated dormitories in broiler farms, and the Full and actual capacity of broiler farms according to poultry capacities, which is the first capacity of farms that produce (5 thousand Less than 25 thousand chickens), the second capacity is farms that produce (25 thousand to less than 100 thousand chickens), and the third capacity is farms that produce (more than 100 thousand chickens) in Egypt and Gharbia Governorate during the study period (2000-2022).

A. The current status of broiler farm production in Egypt:

1. The current status of the number of broiler chicken production farms in Egypt:

It is clear from the data in Table (1) the development of the number of broiler production farms in Egypt, and their relative importance during the period from (2000-2022), as it was found that the minimum number of broiler chicken production farms in Egypt amounted to about 13.53 thousand farms in 2001, while the maximum reached about 22.98 thousand farms in 2021, with an average of about 18.30 thousand farms.

2. The current status of the numbers of activated and deactivated dormitories in broiler chicken farms in Egypt:

The data in Table (1) shows that the minimum total number of dormitories reached about 22.97 thousand dormitories for the years 2020 and 2021, while the maximum amounted to about 104.04 thousand dormitories in 2008, with an average period

of about 51.27 thousand dormitories during the study period.

As for the number of activated dormitories in broiler farms in Egypt during the study period, its minimum was about 10.79 thousand houses in 2020, a percentage of about 46.97% of the total number of dormitories for the same year, while its maximum reached about 30.89 thousand dormitories in 2017, a percentage of about 75.90% of the total number of dormitories for the same year, with an average of about 23.56 thousand dormitories during the study.

As for the number of deactivated dormitories, it was shown from Table (1) that its minimum amounted to about 3.58 thousand dormitories in 2022, a percentage amounting to about 12.12% of the total number of dormitories for the same year, while the maximum amounted to about 82.82 thousand dormitories in 2008, a percentage amounting to about 79.6% of the total number of dormitories for the same year.

3. The current status of the full capacity of broiler chicken farms according to poultry capacities in Egypt

The data in Table (2) shows the development of the total capacity of broiler farms according to the three capacities in Egypt during the study period. As for the total capacity, it reached a minimum of about 699.04 thousand chickens in 2010, while its maximum reached about 1008.43 thousand chickens in 2007, with an average of About 868.01 thousand chickens, and the full capacity of broiler farms in Egypt is divided into three capacities:

- **First capacity:** It appears from the data in Table (2) that the minimum number of broiler chickens reached about 51.24 thousand chickens in 2010, a ratio of about 7.33% of the full capacity for the same year. The maximum number of broiler chickens reached about 110.58 thousand chickens in 2020, at a rate of about 12.17% of the full capacity for the same year, with an average period of about 79.65 thousand chickens.

Table (1): Development of the numbers and dormitories of broiler chickens in Egypt and their relative importance during the period (2000-2022) **(in thousand units)**

Years	Number of farms	Number of dormitories				
		Activated		Deactivated		Total
		Number	%	Number	%	
2000	13.84	17.45	62.54	10.45	37.46	27.90
2001	13.53	18.96	38.17	30.71	61.83	49.67
2002	14.52	20.57	39.44	31.59	60.56	52.16
2003	14.68	20.60	34.44	39.21	65.56	59.81
2004	15.67	20.62	28.02	52.98	71.98	73.60
2005	14.70	20.65	31.48	44.94	68.52	65.59
2007	17.41	21.28	22.05	75.22	77.95	96.50
2008	17.81	21.22	20.40	82.82	79.60	104.04
2009	18.42	22.30	21.88	79.62	78.12	101.92
2010	14.71	23.84	79.55	6.13	20.45	29.97
2011	16.50	26.02	81.41	5.94	18.59	31.96
2012	18.94	28.36	80.48	6.88	19.52	35.24
2013	18.92	28.54	80.74	6.81	19.26	35.35
2014	20.23	30.04	79.91	7.55	20.09	37.59
2015	21.10	30.68	78.11	8.60	21.89	39.28
2016	20.68	30.03	74.35	10.36	25.65	40.39
2017	21.54	30.89	75.90	9.81	24.10	40.70
2018	21.00	30.65	75.42	9.99	24.58	40.64
2019	21.24	30.41	77.58	8.79	22.42	39.20
2020	22.96	10.79	46.97	12.18	53.03	22.97
2021	22.98	10.94	47.63	12.03	52.37	22.97
2022	21.96	25.95	87.88	3.58	12.12	29.53
Average	18.30	23.56	55.87	27.71	44.13	51.27

Source: (1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues.

(2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

- **Second capacity:** As data in Table (2) shows, the minimum number of broiler chickens amounted to about 283.37 thousand chickens in 2006, a percentage amounting to about 29.15% of the full capacity for the same year, while the maximum number of broiler chickens reached about 747.10 thousand chickens in 2004, a rate of about 80.95% of the full capacity for the same year, with an average of about 485.08 thousand chickens during the study period.
- **Third capacity:** While the data in Table (2) shows that the minimum number of broiler chickens reached about 107.70 thousand chickens in 2004, a ratio of about 11.67% of the full capacity for the same year, while the maximum number of broiler chickens reached About 630.53 thousand chickens in 2007, a percentage of about 62.53% of the full capacity for the same year, with an average period of about 303.28 thousand chickens.

4. The current status of the actual capacity of broiler chicken farms according to poultry capacities in Egypt:

The data in Table (3) shows the development of the actual capacity of broiler farms according to the three categories in Egypt during the study period. As for the total actual capacity of the three categories of the number of broiler chickens during the study period, it reached its minimum at about 382.59 thousand chickens in 2008, while it reached its maximum. About 690.39 thousand chickens in 2018, with an average of about 531.64 thousand chickens.

Table (2): Development of the full capacity of broiler farms according to categories in Egypt and its relative importance during the period (2000-2022) (per thousand chickens)

Years	First capacity		Second capacity		Third capacity		Total full capacity
	Number	%	Number	%	Number	%	
2000	77.92	9.37	474.56	57.07	278.99	33.55	831.47
2001	75.47	9.00	442.70	52.81	320.18	38.19	838.35
2002	73.02	8.52	510.83	59.58	273.53	31.90	857.38
2003	70.57	7.86	678.96	75.66	147.89	16.48	897.42
2004	68.12	7.38	747.10	80.95	107.70	11.67	922.92
2005	65.67	8.46	515.23	66.37	195.39	25.17	776.29
2006	63.21	6.50	283.37	29.15	625.46	64.35	972.04
2007	62.14	6.16	315.76	31.31	630.53	62.53	1008.43
2008	61.05	7.99	348.16	45.58	354.71	46.43	763.92
2009	59.32	7.39	380.55	47.38	363.28	45.23	803.15
2010	51.24	7.33	412.95	59.07	234.85	33.60	699.04
2011	62.86	8.46	445.34	59.93	234.85	31.61	743.05
2012	76.04	9.18	506.87	61.19	245.42	29.63	828.33
2013	77.89	9.56	485.49	59.60	251.26	30.84	814.64
2014	89.12	10.31	509.42	58.94	265.80	30.75	864.34
2015	97.51	10.92	520.81	58.34	274.32	30.73	892.64
2016	94.44	10.51	511.52	56.91	292.86	32.58	898.82
2017	98.15	10.45	530.31	56.45	310.94	33.10	939.40
2018	99.87	10.62	539.82	57.40	300.76	31.98	940.45
2019	104.09	11.45	506.70	55.75	298.05	32.79	908.84
2020	110.58	12.17	502.15	55.28	295.65	32.55	908.38
2021	98.12	10.88	474.24	52.58	329.64	36.55	902.00
2022	95.56	10.03	513.93	53.94	343.37	36.04	952.86
Average	79.65	9.18	485.08	56.17	303.28	34.71	868.01

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).

Source :(1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues.

(2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

- **First capacity:** It is shown from the data in Table (3) that the minimum number of broiler chickens reached about 34.71 thousand chickens in 2010, a ratio of about 7.83% of the total actual

capacity for the same year. The maximum number of broiler chickens reached about 70.68 thousand chickens in 2020, at a rate of about 11.35% of the total actual capacity for the same year, with an average period of about 47.98 thousand chickens.

- **Second capacity:** As the data in Table (3) shows that the minimum number of broiler chickens reached about 261.51 thousand chickens in 2010, a percentage amounting to about 59.01% of the total actual capacity for the same year, while the maximum number of broiler chickens reached about 342.87 thousand chickens in 2018, a rate of about 49.66% of the total actual capacity for the same year, with an average of about 319.42 thousand chickens during the study period.
- **Third capacity:** The data in Table (3) shows that the minimum number of chickens for meat production amounted to about 16.23 thousand chickens in 2008, a ratio of about 4.24% of the total actual capacity for the same year, while the maximum number Chicken meat production reached about 283.89 thousand chickens in 2018, a rate of about 41.12% of the total capacity for the same year, with an average period of about 164.25 thousand chickens.

B. The current status of broiler farm production in Gharbia Governorate:

This part is concerned with studying the development of the number of farms operating in meat production in Gharbia Governorate during the period (2000-2022), in addition to studying the development of the number of activated and deactivated farms and the total and actual capacity of the meat farms with their three capacities in Gharbia Governorate during the study period.

Table (3): Development of the actual capacity of broiler farms according to categories in Egypt and its relative importance during the period (2000-2022) **(per thousand chickens)**

Years	First capacity		Second capacity		Third capacity		Total actual capacity
	Number	%	Number	%	Number	%	
2000	37.21	8.35	314.59	70.58	93.89	21.07	445.69
2001	38.42	8.45	320.15	70.40	96.18	21.15	454.75
2002	38.74	6.17	322.70	51.37	266.70	42.46	628.14
2003	39.78	7.05	329.86	58.47	194.48	34.47	564.12
2004	40.13	7.94	330.49	65.38	134.88	26.68	505.50
2005	41.81	8.51	331.59	67.50	117.83	23.99	491.23
2006	40.54	8.77	328.99	71.16	92.81	20.07	462.34
2007	37.89	8.61	330.21	75.02	72.05	16.37	440.10
2008	36.49	9.54	329.87	86.22	16.23	4.24	382.59
2009	35.87	8.79	327.89	80.31	44.52	10.90	408.28
2010	34.71	7.83	261.51	59.01	146.94	33.16	443.16
2011	37.56	7.83	281.20	58.60	161.07	33.57	479.83
2012	45.73	8.91	298.45	58.18	168.80	32.91	512.98
2013	48.92	8.98	320.83	58.90	174.95	32.12	544.70
2014	56.47	9.77	334.09	57.82	187.26	32.41	577.82
2015	61.38	10.42	334.63	56.81	192.99	32.77	589.00
2016	51.70	8.96	285.75	49.53	239.51	41.51	576.96
2017	64.73	10.87	337.62	56.72	192.89	32.41	595.24
2018	63.63	9.22	342.87	49.66	283.89	41.12	690.39
2019	66.23	11.14	334.62	56.29	193.61	32.57	594.46
2020	70.68	11.35	330.71	53.09	221.57	35.57	622.96
2021	63.80	10.02	328.62	51.64	244.00	38.34	636.42
2022	51.08	8.79	289.35	49.79	240.67	41.42	581.10
Average	47.98	9.02	319.42	61.41	164.25	29.62	531.64

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).

Source :(1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues (2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

1. **The current status of the number of broiler chicken farms in Gharbia Governorate:**

It is clear from the data in Table (4) the development of the number of broiler farms in Gharbia Governorate and their relative importance during the period from (2000-2022). The table shows that the number of broiler farms in Gharbia Governorate reached a minimum of about 1.43 thousand farms in 2000, in its maximum reached about 3 thousand farms in 2012, with an average of about 2.16 thousand farms during the study period.

2. **The current status of the numbers of activated dormitories and deactivated dormitories in broiler chicken farms in Gharbia Governorate:**

As for the total number of dormitories, its minimum reached about 2.28 thousand in 2019, while its maximum reached about 3.82 thousand dormitories in 2012, with an average period of about 2.93 thousand dormitories during the study period, Table (4).

Table (4) Development of the numbers and dormitories of broiler chickens in Gharbia Governorate and their relative importance during the period (2000-2022) (in thousand units)

Years	Number of farms	Number of dormitories				
		Activated		Deactivated		Total
		Number	%	Number	%	
2000	1.43	2.75	94.18	0.17	5.82	2.92
2001	1.80	2.43	93.10	0.18	6.90	2.61
2002	1.90	2.58	93.14	0.19	6.86	2.77
2003	1.92	2.59	91.52	0.24	8.48	2.83
2004	1.95	2.58	90.85	0.26	9.15	2.84
2005	1.79	2.64	93.29	0.19	6.71	2.83
2006	2.00	2.47	84.01	0.47	15.99	2.94
2007	1.96	2.48	87.02	0.37	12.98	2.85
2008	2.00	2.46	84.83	0.44	15.17	2.90
2009	1.92	2.50	89.29	0.30	10.71	2.80
2010	2.07	2.82	98.95	0.03	1.05	2.85
2011	2.52	3.28	99.39	0.02	0.61	3.30
2012	3.00	3.80	99.48	0.02	0.52	3.82
2013	2.81	3.56	99.44	0.02	0.56	3.58
2014	2.77	3.55	99.16	0.03	0.84	3.58
2015	2.56	3.29	99.10	0.03	0.90	3.32
2016	2.28	2.94	98.99	0.03	1.01	2.97
2017	2.18	2.76	98.92	0.03	1.08	2.79
2018	2.21	2.87	100.00	0	0	2.87
2019	1.77	2.27	99.47	0.01	0.53	2.28
2020	2.58	1.20	46.51	1.38	53.49	2.58
2021	2.58	1.20	46.51	1.38	53.49	2.58
2022	1.77	2.36	94.02	0.15	5.98	2.51
Average	2.16	2.67	90.49	0.26	9.51	2.93

Source: (1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues. (2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

The data in Table (4) shows that the number of activated dormitories in broiler production farms in Egypt during the study period reached a minimum of about 1.20 thousand activated dormitories in 2020 and 2021, representing about 46.51% of the total number of dormitories, while its maximum reached about 3.80 thousand dormitories in 2012 amounted to about 99.48% of the total number of activated dormitories for the same year, with an average of about 2.67 thousand activated dormitories during the study period, while it was found that the total number of dormitories in 2018 in Gharbia Governorate were activated dormitories, as their number reached about 2.87 thousand activated dormitories, i.e. a percentage of 100 %.

As for the number of deactivated dormitories, it was shown from Table (4) that its minimum amounted to about 0.01 thousand wards in 2019, a percentage amounting to about 0.53% of the total number of dormitories for the same year, while its

maximum amounted to about 1.38 thousand deactivated dormitories in 2020 and 2021, a percentage It amounted to about 53.49% of the total number of dormitories for the same two years, with an average of about 0.26 thousand deactivated dormitories during the study period.

3. **The current status of the full capacity of broiler chicken farms according to the three poultry holding capacities in Gharbia Governorate:**

The data in Table (5) shows the development of the full capacity of broiler farms according to the three capacities in Gharbia Governorate during the study period. As for the total full capacity of the three categories of the number of broiler chickens in Gharbia Governorate during the study period, it reached its minimum at about 60.87 thousand chickens in 2019, while it reached the maximum amount was about 118.19 thousand chickens in 2006, with an average of about 87.82 thousand chickens during the study period.

- **First capacity:** It appears from the data in Table (5) that the minimum number of broiler chickens in Gharbia Governorate amounted to about 6.24 thousand chickens in 2009, representing about 8.66% of the total full capacity for the same year. The maximum number of broiler chickens in Gharbia Governorate reached about 12.62 thousand chickens in 2012, representing about 12.33% of the total full capacity for the same year, with an average period of about 9.57 thousand chickens.

Table (5): Development of the full capacity of broiler farms according to categories in Gharbia and its relative importance during the period (2000-2022) (per thousand chickens)

Years	First capacity		Second capacity		Third capacity		Total full capacity
	Number	%	Number	%	Number	%	
2000	77.92	9.37	474.56	57.08	278.99	33.55	831.47
2001	75.47	9.00	442.70	52.81	320.18	38.19	838.35
2002	73.02	8.52	510.83	59.58	273.53	31.90	857.38
2003	70.57	7.86	678.96	75.66	147.89	16.48	897.42
2004	68.12	7.38	747.10	80.95	107.70	11.67	922.92
2005	65.67	8.46	515.23	66.37	195.39	25.17	776.29
2006	63.21	6.50	283.37	29.15	625.46	64.35	972.04
2007	62.14	6.16	315.76	31.31	630.53	62.53	1008.43
2008	61.05	7.99	348.16	45.58	354.71	46.43	763.92
2009	59.32	7.39	380.55	47.38	363.28	45.23	803.15
2010	51.24	7.33	412.95	59.07	234.85	33.60	699.04
2011	62.86	8.46	445.34	59.93	234.85	31.61	743.05
2012	76.04	9.18	506.87	61.19	245.42	29.63	828.33
2013	77.89	9.56	485.49	59.60	251.26	30.84	814.64
2014	89.12	10.31	509.42	58.94	265.80	30.75	864.34
2015	97.51	10.92	520.81	58.34	274.32	30.73	892.64
2016	94.44	10.51	511.52	56.91	292.86	32.58	898.82
2017	98.15	10.45	530.31	56.45	310.94	33.10	939.40
2018	99.87	10.62	539.82	57.40	300.76	31.98	940.45
2019	104.09	11.45	506.70	55.75	298.05	32.79	908.84
2020	110.58	12.17	502.15	55.28	295.65	32.55	908.38
2021	98.12	10.88	474.24	52.58	329.64	36.55	902.00
2022	95.56	10.03	513.93	53.94	343.37	36.04	952.86
Average	79.65	9.18	485.08	56.14	303.28	34.71	868.01

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).

Source :(1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues

(2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

- **Second capacity:** The data in Table (5) shows that the minimum number of broiler chickens amounted to about 20.50 thousand chickens in 2007, representing about 27.71% of the

total full capacity for the same year, while the maximum number of broiler chickens reached about 87.30 thousand chickens in 2006, representing It amounted to about 73.86% of the total full farm capacity for the same year, with an average period of about 59.33 thousand chickens

- **Third capacity:** The data in Table (5) shows that the minimum number of broiler chickens amounted to about 6.86 thousand chickens in 2019, representing about 11.27% of the total full capacity for the same year, while the maximum number of broiler chickens reached about 44.95 thousand chickens in 2007, representing It amounted to about 60.75% of the total full farm capacity for the same year, with an average period of about 18.91 thousand chickens.

4. The current status of the actual capacity of broiler production farms according to poultry categories in Gharbia Governorate:

The data in Table (6) shows the development of the actual capacity of broiler farms according to the three categories in Gharbia Governorate during the study period. As for the total actual capacity of the three capacities of the number of broiler chickens during the study period, it reached its minimum at about 42.19 thousand chickens in 2021, while it reached its maximum. About 94.54 thousand chickens in 2006, with an average of about 62.57 thousand chickens during the study period.

- **First capacity:** It is shown in Table (6) that the minimum number of broiler chickens reached about 3.84 thousand chickens in 2022, at a rate of about 6.62% of the total actual capacity for the same year. The maximum number of broiler chickens also reached about 8.69 thousand chickens in 2005, at a rate of about 10.91% of the total actual capacity for the same year, with an average period of about 6.63 thousand.

Table (6): Development of the actual capacity of broiler farms according to categories in Gharbia and its relative importance during the period (2000-2022) (per thousand chickens)

Years	First capacity		Second capacity		Third capacity		Total actual capacity
	Number	%	Number	%	Number	%	
2000	8.20	9.89	55.74	67.24	18.96	22.87	82.90
2001	8.29	9.96	56.21	67.54	18.72	22.49	83.22
2002	8.39	10.49	57.84	72.30	13.77	17.21	80.00
2003	8.43	10.02	58.23	69.22	17.46	20.76	84.12
2004	8.55	9.94	59.87	69.58	17.63	20.49	86.05
2005	8.69	10.91	60.55	75.99	10.44	13.10	79.68
2006	7.85	8.30	58.74	62.13	27.95	29.56	94.54
2007	6.98	10.49	49.78	74.80	9.79	14.71	66.55
2008	4.98	8.12	46.21	75.35	10.14	16.53	61.33
2009	4.13	9.28	39.78	89.39	0.59	1.33	44.50
2010	3.86	8.27	32.04	68.64	10.78	23.09	46.68
2011	5.23	9.58	42.40	77.70	6.94	12.72	54.57
2012	8.02	12.43	42.02	65.14	14.47	22.43	64.51
2013	6.61	11.71	43.11	76.38	6.72	11.91	56.44
2014	7.23	12.54	42.59	73.85	7.85	13.61	57.67
2015	6.66	12.30	39.77	73.46	7.71	14.24	54.14
2016	6.28	12.48	36.65	72.80	7.41	14.72	50.34
2017	7.50	13.56	41.00	74.11	6.82	12.33	55.32
2018	6.53	13.07	35.70	71.44	7.74	15.49	49.97
2019	5.97	13.87	32.37	75.23	4.69	10.90	43.03
2020	5.50	12.72	30.52	70.60	7.21	16.68	43.23
2021	4.86	11.52	30.29	71.79	7.04	16.69	42.19
2022	3.84	6.62	47.26	81.45	6.92	11.93	58.02
Average	6.63	10.60	45.16	72.49	10.77	17.22	62.57

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).

Source :(1) Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Statistics of Poultry, various issues

(2) Data for 2022 - Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, unpublished data.

- **Second capacity:** The data in Table (6) shows that the minimum number of broiler chickens reached about 30.29 thousand chickens in 2021, a percentage of about 71.79% of the total actual capacity for the same year, while the maximum number of broiler chickens reached about 60.55 thousand chickens in 2005, a percentage of About 75.99% of the total actual capacity for the same year, with an average of about 45.16 thousand chickens during the study period.
- **Third capacity:** While the data in Table (6) shows that the minimum number of broiler chickens reached about 0.59 thousand chickens in 2009, a ratio of about 1.33% of the total actual capacity for the same year, while the maximum number of chickens for meat production reached about 27.95 thousand chickens in the year. 2006, at a rate of about 29.56% of the total actual capacity for the same year, with an average period of about 10.77 thousand chickens.

Second: Estimating time series models for the production of broiler chicken farms in Egypt and Gharbia Governorate

To estimate time series models with a good ability to predict the values of each of the research variables for the production of broiler farms in Egypt and Gharbia Governorate, a unit root test was conducted to test whether the time series was stationary or not, determine the time difference for the stability of the time series, and then determine the suitable time series model. Suitable for describing each of the variables under consideration, and finally testing the ability of time series models to predict.

1. **Time series stationarity test:** To test the status of the time series of the study variables in terms of stability or not, Unit Root Tests were conducted, which is the Augmented Dickey-Fuller test. The data in Table (7) shows that the value of (t) calculated at both the 1% and 5% significance levels are less than the tabular (t) of the original time series (level) for all study variables according to the models in their three forms, in terms of the presence of a constant term and/or the general trend (Intercept – Intercept & Trend-None) during the period (2000-2022), and this indicates the presence of a unit root for these time series, meaning that they are unstable (not static), and to overcome this problem, the test is performed after taking the first differences (1^{st} difference) for these time series concerned with the study. It is clear from the data of the same table that the value of (t) calculated at the 5% level of significance is greater than the (t) tabulated for the first difference series for all study variables according to the model that contains the constant term and the general time trend (Intercept & Trend) during the period (2000-2022). That is, there is no unit root for these time series, which means they are stable.

2. **Estimating the (1ARI term) model for the time series of the study variables:** It is clear from the above that the series models are stable at the first difference for each of the variables concerned with the study. Therefore, the time series model parameters for these variables are estimated using the (1ARI model). The results were as follows:

Equation No. (1) In Table (8) shows that the number of farms in Egypt took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.88 thousand farms during the study period. The value of the coefficient of determination also indicates that about 81% of the changes that occur in the number of farms it is due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

By studying Equation No. (2) in Table (8), it was found that the number of activated dormitories in Egypt took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.57 thousand dormitories during the study period. The value of the coefficient of determination also indicates that about 34% of the changes that occur in the number of activated dormitories in Egypt are due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

As for Equation No. (3) the same table, shows that the number of deactivated dormitories in Egypt took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.78 thousand dormitories during the study period. The value of the coefficient of determination also indicates that about 60% of the changes that occur in the number of deactivated dormitories are due to changes whose effect reflects the time element, assuming other factors are constant. The (F) value also shows the significance of the function at a significance level of 0.01.

Equation No. (4) shows that the total number of dormitories in Egypt took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.74 thousand dormitories during the study period. The value of the coefficient of determination also indicates that about 55% of the changes that occur in the total number of dormitories are due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

The data of Equation No. (5) in Table (8) also showed that the number of farms in Gharbia Governorate took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.60 thousand farms during the study period. The value of the coefficient of determination also indicates that about 40% of the changes that occur in the number of farms are due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

Table (7) Augmented Dickey-Fuller Unit root test statistic for numbers of farms, production dormitories, and full and actual capacity of broiler chickens in Egypt and Gharbia Governorate during the period (2000 - 2022)

series	Variable		(Level)			st difference		
			Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None
	Test critical values 1% level		**-3.8**	**-4.4**	**-2.7**	**-3.8**	**-4.5**	**-2.7**
	Test critical values 5% level		**-3.0**	**-3.6**	**-2.0**	**-3.0**	**-3.6**	**-2.0**
Augmented Dickey-Fuller test statistic								
1	**Numbers of farms, production dormitories**	Number of farms in Egypt	**-1.2**	**-3.7**	**1.040**	**-5.9**	**-5.8**	**-5.4**
2		Number of activated dormitories in Egypt	**-2.9**	**-3.4**	**-0.2**	**-4.6**	**-4.8**	**-4.8**
3		Number of deactivated dormitories in Egypt	**-1.5**	**-2.4**	**-1.1**	**-4.7**	**-4.6**	**-4.8**
4		Number of total dormitories in Egypt	**-1.7**	**-2.7**	**-0.7**	**-4.8**	**-4.7**	**-4.9**
5		Number of farms in Gharbia	**-2.5**	**-2.0**	**-0.2**	**-4.0**	**-4.1**	**-4.2**
6		Number of activated dormitories in Gharbia	**-3.2**	**-3.1**	**-0.5**	**-3.5**	**-3.7**	**-4.2**
7		Number of deactivated dormitories in Gharbia	**-4.1**	**-4.0**	**-3.0**	**-5.2**	**-5.1**	**-5.3**
8		Number of total dormitories in Gharbia	**-1.4**	**-1.4**	**-0.5**	**-4.6**	**-4.7**	**-4.7**
9	**Full Capacity**	First capacity in Egypt	**-0.6**	**-1.9**	**0.5**	**-3.5**	**-3.4**	**-3.5**
10		Second capacity in Egypt	**-3.8**	**-3.7**	**-0.3**	**-4.9**	**-4.8**	**-5.0**
11		Third capacity in Egypt	**-3.7**	**-3.6**	**-0.7**	**-3.8**	**-4.0**	**-3.9**
12		Total capacity in Egypt	**-2.8**	**-2.9**	**0.1**	**-6.0**	**-5.8**	**-6.1**
13		First capacity in Gharbia	**-1.46**	**-1.49**	**-0.8**	**-3.6**	**-3.7**	**-3.6**
14		Second capacity in Gharbia	**-3.1**	**-3.0**	**-0.4**	**-5.3**	**-5.2**	**-5.5**
15		Third capacity in Gharbia	**-1.9**	**-3.2**	**-1.3**	**-5.4**	**-5.2**	**-5.4**
16		Total capacity in Gharbia	**-2.69**	**-3.17**	**-0.42**	**-6.3**	**-6.2**	**-6.5**
17	**Actual Capacity**	First capacity in Egypt	**-1.3**	**-1.6**	**0.2**	**-3.9**	**-3.7**	**-4.0**
18		Second capacity in Egypt	**-2.9**	**-2.8**	**-0.4**	**-5.0**	**-4.9**	**-5.2**
19		Third capacity in Egypt	**-2.0**	**-2.5**	**-0.3**	**-5.6**	**-5.5**	**-5.5**
20		Total capacity in Egypt	**-1.8**	**-2.1**	**0.2**	**-4.9**	**-4.8**	**-5.0**
21		First capacity in Gharbia	**-1.2**	**-1.7**	**-1.1**	**-3.9**	**-3.8**	**-3.8**
22		Second capacity in Gharbia	**-1.5**	**-1.6**	**-0.6**	**-3.0**	**-3.9**	**-3.1**
23		Third capacity in Gharbia	**-1.9**	**-5.3**	**-1.5**	**-10.0**	**-9.8**	**-10.0**
24		Total capacity in Gharbia	**-1.7**	**-2.2**	**-0.9**	**-5.1**	**-5.0**	**-5.1**

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).
Source: Results of data analysis of Tables (1-6) using the statistical program (EViews 7).

Equation No. (6) in Table (8) shows that the number of activated dormitories in Gharbia Governorate took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.78 thousand activated dormitories during the study period. The value of the coefficient of determination also indicates that about 60% of the changes that occur in the number of activated dormitories in Gharbia Governorate are due to changes whose effect reflects the time element while assuming other factors to be constant. The (F) value also shows the significance of the function at a significance level of 0.01.

As for Equation No. (7) the same table, shows that the number of deactivated dormitories in Gharbia Governorate took a general, statistically significant increasing trend at the level of 0.05, amounting to about 0.44 thousand deactivated dormitories during the study period. The value of the coefficient of determination also indicates that about 19% of the changes that occur in the number of deactivated dormitories are due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.05.

Equation No. (8) showed that the total number of dormitories in Gharbia Governorate took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.79 thousand dormitories during the study period. The value of the coefficient of determination also indicates that about 59% of the changes that occur in the total number of dormitories are due to changes whose effect reflects the time element, assuming other factors are constant, as the (F) value shows the significance of the function at a significance level of 0.01.

Table (8) Estimation results of (ARI term1) models for time series for numbers of farms, production dormitories, and full and actual capacity of broiler chickens in Egypt and Gharbia Governorate during the period (2000 - 2022)

SN	Variable		Constant		AR (1)		R^2	F	Theil Inequality Coefficient
			Coefficient	t-Statistic	Coefficient	t-Statistic			
1	Numbers of farms, production dormitories	Number of farms in Egypt	21.25	(6.01)**	0.88	(9.1)**	0.81	(82.82)**	0.043
2		Number of activated dormitories in Egypt	24.35	(9.8)**	0.57	(3.22)**	0.34	(10.35)**	0.115
3		Number of deactivated dormitories in Egypt	27.39	1.54	0.78	(5.43)**	0.60	(29.5)**	0.455
4		Number of total dormitories in Egypt	52.54	(3.49)**	0.74	(4.96)**	0.55	(24.56)**	0.258
5		Number of farms in Gharbia	2.22	(13.89)**	0.60	(3.69)**	0.40	(13.61)**	0.078
6		Number of activated dormitories in Gharbia	2.60	(6.52)**	0.78	(5.43)**	0.60	(29.48)**	0.117
7		Number of deactivated dormitories in Gharbia	0.26	1.92	0.44	(2.19)*	0.19	(4.78)*	0.528
8		Number of total dormitories in Gharbia	2.86	(10.97)**	0.79	(5.33)**	0.59	(28.46)**	0.065
9	Full Capacity	First capacity in Egypt	95.79	(3.33)*	0.95	(11.59)**	0.87	(134.24)**	0.095
10		Second capacity in Egypt	488.80	(10.02)**	0.64	(3.79)**	0.41	(14.15)**	0.103
11		Third capacity in Egypt	307.38	(6.60)**	0.51	(2.62)*	0.25	(6.84)**	0.188
12		Total capacity in Egypt	514.85	(2.83)**	-0.59	(281)**	0.28	(7.89)**	0.044
13		First capacity in Gharbia	9.34	(12.10)**	1.03	(4.63)**	0.56	(25.07)**	0.089
14		Second capacity Gharbia	42.7	(3.12)**	-0.72	(-3.13)**	0.33	(9.82)**	0.127
15		Third capacity Gharbia	16.76	(2.94)**	0.70	(4.35)**	0.49	(18.95)**	0.245
16		Total capacity Gharbia	87.55	(15.90)**	0.46	(2.29)*	0.21	(5.25)*	0.083
17	Actual Capacity	First capacity in Egypt	52.77	(5.23)**	0.87	(8.65)**	0.79	(74.79)**	0.096
18		Second capacity in Egypt	208.42	(2.92)**	-0.65	(2.95)**	0.30	(8.68)**	0.033
19		Third capacity in Egypt	179.95	(5.07)**	0.65	(3.82)**	0.42	(14.58)**	0.197
20		Total capacity in Egypt	553.23	(11.63)**	0.74	(5.15)**	0.57	(26.52)**	0.073
21		First capacity in Gharbia	5.64	(3.65)**	0.82	(5.54)**	0.61	(30.72)**	0.104
22		Second capacity Gharbia	42.85	(6.21)**	0.83	(7.12)**	0.72	(50.74)**	0.085
23		Third capacity Gharbia	10.17	(5.77)**	0.29	1.43	0.09	0.17	0.252
24		Total capacity Gharbia	57.26	(5.62)**	0.79	(6.52)**	0.68	(42.45)**	0.094

First capacity (farms from 5 thousand to less than 25 thousand chickens) - Second capacity (farms from 25 thousand to less than 100 thousand chickens) - Third capacity (farms of 100,000 chickens or more).

Included observations: 22 after adjustments **Sample (adjusted): 2001 -2022**.

Source: Results of data analysis of Tables (1-7) using the statistical program (Eviews 7)

Regarding the full capacity of broiler farms according to the three capacities in Egypt and Gharbia Governorate:

Concerning the data for **the first capacity** of the full capacity of broiler chicken farms **in Egypt**, as shown in Equation No. (9), which took a general increasing trend that is statistically significant at the level of 0.01, it reached about 0.95 thousand. Chicken during the study period and the value of the coefficient of determination indicates that about 87% of the changes that occur in the full capacity of first-capacity broiler farms in Egypt are due to changes whose effect reflects the time element while assuming other factors to be constant, as the value of (F) shows. The function is significant at a significance level of 0.01.

As for the data on **the second capacity** of the full capacity of broiler chicken farms **in Egypt**, as shown in Equation No. (10), which took a general increasing trend, statistically significant, at the level of 0.01, it reached about 0.64 thousand. Chicken during the study period. The value of the coefficient of determination also indicates that about 41% of the changes that occur in the full capacity of second capacity broiler farms in Egypt are due to changes whose effect reflects the time element while assuming other factors are constant, as the value of (F) shows. The function is significant at a significance level of 0.01.

As for the data on **the third capacity** of the full capacity of broiler farms **in Egypt**, as shown in Equation No. (11), which took a general increasing, statistically significant trend at the level of 0.05, amounting to about 0.51 thousand chickens during the study period, The value of the coefficient of determination also indicates that about 25% of the changes that occur in the full capacity of third-capacity broiler farms in Egypt are due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the equation at a significant level. 0.01.

As for the **total full capacity** of broiler chickens **in Egypt**, Equation No. (12) shows that it took a general, statistically significant decreasing trend at the level of 0.01, amounting to about 0.59 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 28% of the changes that occur in the total full capacity of broiler chickens in Egypt is due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the equation at a significance level of 0.01.

Equation No. (13) Shows that, with respect to **the first capacity**, the full capacity of broiler farms **in Gharbia Governorate** took a general, statistically significant increasing trend at the level of 0.01, amounting to about 1.03 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 56% of the changes that it occurs in the full capacity of the first capacity farms of broiler chickens in Gharbia Governorate and is due to changes whose effect reflects the time element while assuming the stability of other factors. The value of (F) also shows the significance of the function at a significance level of 0.01.

As for the **second capacity** data, it is shown in Equation No. (14) that the full capacity of broiler farms in **Gharbia Governorate** took a general decreasing trend, statistically significant at the level of 0.01, amounting to about 0.72 thousand chickens during the study period. The value of the coefficient of determination also indicates that it is about 33%. Of the changes that occur in the full capacity of second-capacity broiler farms in Gharbia Governorate, they are due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

As for the **third capacity** data, it is shown in Equation No. (15) that the total capacity of broiler farms in Gharbia Governorate took a general, increasing, statistically significant trend at the level of 0.01, amounting to about 0.70 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 49% of the changes that occur in the full capacity of the third capacity farms for broiler chickens in Gharbia Governorate are due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

As for the **total full capacity** of broiler chickens **in Gharbia Governorate**, according to Equation No. (16), it was found that it took a general, statistically significant increasing trend at the level of 0.05, amounting to about 0.46 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 21% of the changes that occur in the total full capacity of broiler chickens is due to changes whose effect reflects the time element, assuming other factors are constant. The value of (F) also shows the significance of the function at a significance level of 0.05.

Regarding the actual capacity of broiler farms according to the three capacities in Egypt and Gharbia Governorate:

It was shown from the study of the **first capacity** shown in Equation No. (17) that the actual capacity of broiler farms **in Egypt** took a general increasing trend, statistically significant, at 0.01, amounting to about 0.87 thousand chickens. The value of the coefficient of determination also indicated that about 79% of the changes that occur in the actual capacity of the first capacity of broiler chickens in Egypt is due to the changes whose effect reflects the time element while assuming other factors to be constant. The significance of the equation was proven at the level of 0.01.

As for the **second capacity**, as shown in Equation No. (18), the actual capacity of broiler farms **in Egypt** took a general, statistically significant decreasing trend at 0.01, amounting to about 0.65 thousand chickens. The value of the coefficient of determination also indicated that about 30% of the changes that occur in the actual capacity of the second capacity for broiler chickens in Egypt is due to changes whose effect reflects the time element while assuming other factors to be constant. The significance of the equation was proven at the level of 0.01.

As for the **third capacity** data, as shown in Equation No. (19), the actual capacity of broiler farms **in Egypt** took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.65 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 42% of the changes that it occurs in the actual capacity of the third capacity of broiler farms in Egypt and is due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the equation at a significance level of 0.01.

As for the **total actual capacity** of broiler chickens **in Egypt**, according to Equation No. (20), it was found that the total actual capacity took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.74 thousand chickens. The value of the coefficient of determination also indicates that about 57% of the changes that occur in the total actual capacity of broiler farms in Egypt is due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the equation at a significance level of 0.01.

As for **Gharbia Governorate**, the study of the **first capacity** of broiler chickens, as shown in Equation No. (21), showed that the actual capacity of broiler farms in **Gharbia Governorate** took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.82 thousand chickens. The value of the coefficient of determination also indicated that about 61% of the changes that occur in the actual capacity of the first capacity of broiler chickens are due to changes whose effect reflects the time element, assuming that other factors are constant. The significance of the equation was proven at the level of 0.01.

As for the **second capacity** of broiler chickens in **Gharbia Governorate**, Equation No. (22) shows that the actual capacity of broiler farms in Gharbia Governorate took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.83 thousand chickens. The value of the coefficient of determination also indicated that about 72% of the changes occurs in the actual capacity of the second capacity of broiler chickens in Gharbia Governorate is due to the changes whose effect reflects the time element while assuming the stability of other factors, and the significance of the equation was proven at the level of 0.01.

As for the **third capacity** data, as shown in Equation No. (23), it was found that the actual capacity of broiler farms in **Gharbia Governorate** took a general decreasing trend that was not statistically significant, amounting to about 0.29 thousand chickens. The value of the coefficient of determination also indicated that about 9% of the changes that occurs in the actual capacity of the third capacity of broiler chickens in Gharbia Governorate is due to changes whose effect reflects the time element while assuming other factors to be constant, and the significance of the equation has not been proven statistically.

As for the **total actual capacity** of broiler chickens in Gharbia Governorate, according to Equation No. (24), it was found that it took a general, statistically significant increasing trend at the level of 0.01, amounting to about 0.79 thousand chickens during the study period. The value of the coefficient of determination also indicates that about 68% of the changes that occur in the total actual capacity of broiler chickens is due to changes whose effect reflects the time element while assuming other factors to be constant. The value of (F) also shows the significance of the function at a significance level of 0.01.

3. Testing the ability of estimated time series models to predict:

The data in Table (8) shows the results of calculating the **Thiel inequality coefficient** to infer the ability of time series models of study variables estimated during the study period (2000 - 2022) to predict values in the following years. It is clear from these results that the Thiel inequality coefficient for each model it is close to zero, which means that these models have good predictive power.

Third: Analysis of the components of production costs per thousand chicks in broiler farms for different production capacities in the study sample in Gharbia Governorate.

The elements of production costs for broiler farms in the study sample in Gharbia Governorate include each capacity of the sample, where the sample was divided into three capacities in terms of the average number of chicks/cycles. These capacities are: the first capacity (3000 chicks or fewer), and the second capacity (more than 3000-6000), and the third capacity (more than 6000).

Production costs are divided into (a) **physical costs**, which are represented by: (1) human labor, (2) production requirements (fodder - number of chicks - amount of bedding), (b) **monetary costs**, which are represented by the costs of: **(1) Fixed costs** (rent), (2) **variable costs**, which include: human labor, production requirements (fodder-chicks-bedding-veterinary care - electricity-water, gas, operation of the electricity generator).

According to the first, second, and third production capacities in the study sample during the 2023 production season, Table (9) shows that the number of farms in each Capacity was about 14, 22, and 14 farms, respectively, with a total of 50 farms for the sample, while the average number of annual cycles was about 3.21. 2.77 And 2.57 cycles, respectively, with an average for the total sample of about 2.54 cycles. Table (9) also shows that the average number of chicks/cycles was about 2.31, 4.73, and 11.16 thousand chicks/cycle, respectively, and the average for the total sample was about 5.86 thousand chicks/cycle.

Table (9) Physical costs per thousand chicks on broiler farms for different production capacities in the study sample in Gharbia Governorate in 2023

Physical costs			Unit	Frist capacity	second capacity	third capacity	Total sample
Number of farms			number	14	22	14	50
Average courses per year			number	3.21	2.77	2.57	2.84
Number of chicks/cycles			chicken	2.31	4.73	11.16	5.86
Human labor			man/day	1.21	1.40	1.27	1.31
Production requirements	fodder	Starter fodder	ton	0.79	0.69	0.55	0.68
		growing fodder	ton	1.49	1.63	1.37	1.52
		finishing fodder	ton	1.04	1.02	0.91	0.99
		Total fodder	ton	3.32	3.34	2.83	3.19
	Number of chicks		chicken	1000	1000	1000	1000
	amount of bedding		m^3	3.11	2.96	1.91	2.71

First capacity: (3000 chicks or fewer) - Second capacity: (more than 3000 - 6000) - Third capacity: (more than 6000).

Source: Results of analysis of field study data in Gharbia Governorate in 2023.

Both the physical and monetary costs of broiler production farms have been estimated at the three production capacities (for an average of a thousand chicks) during the cycle for the study sample farms during the 2023 production season, and will be reviewed as follows:

(1) Human Labor: Data from tables (9), (10) show that the average total human labor required for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 1.21, 1.40, and 1.27 men/day, respectively, with a value of 4.45, 4.46, 4.67 thousand pounds per thousand chicks, representing about 4.33%, 4.47%, and 5.15%, ranking fourth among the total costs items for the three capacities per thousand chicks, amounting to about 102.66, 99.61, and 90.77 thousand pounds per thousand chicks for the three capacities, respectively. With an overall average of about 1.31 men/day/thousand chicks, and a value of about 45.14 thousand pounds/thousand chicks for the total labor in the study sample, representing about 4.6% of the total costs of the total study sample per thousand chicks, amounting to about 97.99 pounds/thousand chicks.

Human labor costs are divided into fixed labor costs and temporary labor, as the data in Table (10) indicates that the average **fixed labor costs** required for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 2.21, 1.92, and 1.62 thousand pounds/thousand chicks, representing About 2.15%, 1.93%, 1.5%, with an average fixed labor costs of about 1.85, representing about 1.88% of the total costs of the total study sample per thousand chicks.

The data in Table (10) also indicates that the average **costs of temporary labor** required for every thousand chicks during the cycle at the first,

second, and third production capacities amounted to about 2.23, 2.54, and 3.31 thousand pounds per thousand chicks, representing about 2.18%, 2.55%, and 3.65%, with an average cost for temporary labor. It amounted to about 2.67 thousand pounds per thousand chicks, representing about 2.72% of the total costs of the total study sample per thousand chicks.

Table (10) Cash costs per thousand chicks on broiler farms for different production capacities in the study sample in Gharbia Governorate in 2023 One pound/thousand chick

Costs			Frist capacity		second capacity		third capacity		Total sample	
			costs	%	costs	%	costs	%	costs	%
fixed labor			2210.66	2.15	1920.86	1.93	1362.39	1.50	1845.63	1.88
temporary labor			2237.94	2.18	2535.46	2.55	3309.44	3.65	2668.87	2.72
Total labor			4448.60	4.33	4456.32	4.47	4671.83	5.15	4514.50	4.61
Production requirements	fodder	Starter fodder	14960.00	14.57	12734.25	12.78	12183.55	13.42	13203.26	13.47
		Growing fodder	28465.49	27.73	33820.04	33.95	25970.70	28.61	30122.95	30.74
		finishing fodder	19364.49	18.86	19038.66	19.11	17579.83	19.37	18721.42	19.11
		Total fodder	62789.98	61.16	65592.95	65.85	55734.08	61.40	62047.63	63.32
	chicks		21976.32	21.41	21231.25	21.31	21597.54	23.79	21542.43	21.98
	bedding		1267.62	1.23	1109.88	1.11	969.03	1.07	1114.61	1.14
	Veterinary care		5730.14	5.58	3692.07	3.71	5163.11	5.69	4674.62	4.77
	electricity		633.74	0.62	235.89	0.24	211.46	0.23	340.45	0.35
	Water		191.17	0.19	115.92	0.12	89.62	0.10	129.63	0.13
	Gas		969.86	0.94	495.10	0.50	723.90	0.80	692.10	0.71
	Operate the electricity generator		219.95	0.21	86.03	0.09	45.96	0.05	112.31	0.11
	Total production requirements		93778.78	91.35	92559.09	92.92	84534.70	93.13	90653.78	92.51
Variable costs			98227.38	95.68	97015.41	97.39	89206.53	98.28	95168.28	97.12
Rent			4434.16	4.32	2595.54	2.61	1565.09	1.72	2821.83	2.88
Total costs			102661.54	100.0	99610.95	100.0	90771.62	100.0	97990.11	100.0

First capacity: (3000 chicks or fewer) - Second capacity: (more than 3000 - 6000) - Third capacity: (more than 6000).
Source: Results of analysis of field study data in Gharbia Governorate in 2023.

From the above it is clear that the highest percentage of the total labor costs was in the third Capacity, followed by the second and finally the first, as a result of the high costs of temporary labor in the third Capacity, followed by the second and finally the first.

(2) Fodder: Data from tables (9) and (10) indicate that the average total fodder needed for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 3.32, 3.34, and 2.83 tons/thousand chicks, respectively, with a value of 62.79, 65.59, and 55.73. One thousand pounds per thousand chicks, representing about 61.2%, 65.9%, and 61.4%, which ranks first among the total cost items for the three capacities per thousand chicks. With an overall average of about 3.19 tons/thousand chicks, and a value of about 62.05 thousand pounds/thousand chicks for the total study sample, representing about 63.3% of the total costs of the total study sample per thousand chicks.

The fodder is divided into three fodders, which are the starter, growth, and finishing fodder. Data from tables (9) and (10) show that the **average starter fodder** required for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 0.79, 0.69, and 0.55 ton/thousand chicks, respectively, with a value of It amounted to 14.96, 12.73, and 12.18 thousand pounds per thousand chicks, representing about 14.57%, 12.78%, and 13.2%. With an overall average of about 0.68 ton/thousand chicks, and a value of about 13.2 thousand pound/thousand chicks for the total study sample, representing about 13.47% of the total costs of the total study sample per thousand chicks.

Data from tables (9) and (10) also show that the **average growing fodder** needed for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 1.49, 1.63, and 1.37 tons/thousand chicks, respectively, with a value of 28.47, 33.82, and 25.97 thousand pounds/thousand. Chick represents about

27.73%, 33.95%, 28.61%. With an overall average of about 1.52 tons/thousand chicks, and a value of about 30.12 thousand pounds/thousand chicks for the total study sample, representing about 30.74% of the total costs of the total study sample per thousand chicks.

While the data from tables (9) and (10) indicate that the **average finished fodder** required for every thousand chicks during the cycle at the first, second, and third production capacities amounted to about 1.04, 1.02, and 0.91 tons/thousand chicks, respectively, with a value amounting to 19.36, 19.04, and 17.58 thousand pounds/thousand. Chick represents about 18.86%, 19.11%, 19.37%. With a general average of about 0.99 tons/thousand chicks, and a value of about 18.72 thousand pounds/thousand chicks for the total study sample, representing about 19.11% of the total costs of the total study sample per thousand chicks. **From the above it is clear that the highest percentage of the total costs of fodder was in the Capacity the second, followed by the third, and finally the first.**

(3) Number of Chicks: Table data (9), (10) indicate that the average number of chicks reached one thousand chicks during the cycle at the first, second, and third production capacities, and the total sample value amounted to 21.98, 21.23, 21.6, and 21.54 thousand pounds/thousand chicks, representing about 21.4 %, 21.3%, 23.8%, and 21.98% respectively, ranking second among the total cost items for the three capacities and the total sample**. It is also noted that the highest percentage in the costs of chicks was in the third Capacity, followed by the first and finally the second.**

(4) Bedding: Data from tables (9) and (10) show that the average amount of bedding needed for every thousand chicks during the cycle at the first, second, and third production capacities was about 3.11, 2.96, and 1.91 m^3/thousand chicks, respectively, with a value of 1.27, 1.11, and 0.969 thousand pounds/thousand chicks, representing about 1.23%, 1.11%, and 1.07%, occupy fifth place among the total costs items for the three capacities per thousand chicks, with a general average of about 2.71 m^3/thousand chicks, and a value of about 1.11 thousand pounds/thousand chicks for the total sample. The study represents about 1.14% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage in the costs of the litter was in the first (capacity), followed by the second and finally the third.**

(5) Veterinary Care: Data from Table (10) indicate that the average farm spending per thousand chicks on veterinary care during the cycle at the first, second, and third production capacities amounted to about 5.73, 3.69, and 5.16 thousand pounds per thousand chicks, respectively, representing about 5.6%, 3.7%. 5.7%, ranking third among the total cost items for the three capacities per thousand chicks. With an overall average of about 4.67 pounds per thousand chicks, representing about 4.8% of the total costs of the total study sample per thousand chicks. **It is noted that the highest percentage of the costs of veterinary care was in the third (capacity), followed by the first and finally the second.**

(6) Electricity: Data from Table (10) show that the average farm expenditure on electricity per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 633.7, 235.9, and 211.5 pounds per thousand chicks, respectively, representing about 0.62%, 0.24%, 0.23%, ranking seventh among the total costs items for the three capacities per thousand chicks, with an overall average of about 340.5 pounds per thousand chicks, representing about 0.35% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage in the costs of electricity was in the first (capacity) is followed by the second and finally the third.**

(7) Water: Data in Table (10) show that the average farm expenditure on water per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 191.2, 115.9, and 89.6 pounds per thousand chicks, respectively, representing about 0.19%, 0.12%, 0.10%, which ranks eighth among the total cost items for the three capacities per thousand chicks. With an overall average of about 129.6 pounds per thousand chicks, representing about 0.13% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage of water costs was in the first (capacity), followed by the second and finally the third.**

(8) Gas: Data in Table (10) indicate that the average farm expenditure on gas per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 969.9, 495.10, and 723.9 pounds per thousand chicks, respectively, representing about 0.94%, 0.50%, 0.80%, which ranks sixth among the total cost items for the three capacities per thousand chicks. With an overall average of about 692 pounds per thousand chicks, representing about 0.71% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage of gas costs was in the first (capacity), followed by the third and finally the second.**

(9) Operating the Electricity Generator: Data from Table (10) indicate that the average farm expenditure on operating the electricity generator for every thousand chicks on operating the electricity

generator during the cycle at the first, second, and third production capacities amounted to about 219.95, 86, and 45.96 pounds/thousand chicks, respectively, representing about 0.21%, 0.09%, 0.05%, which ranks ninth among the total cost items for the three capacities per thousand chicks. With an overall average of about 112.3 pounds per thousand chicks, representing about 0.11% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage in the costs of the electricity generator was in the first (capacity), followed by the second and finally the third.**

Total Production Requirements Costs: The cost of production requirements includes the cost of each of (fodder- chicks - bedding - veterinary care - electricity - water, gas, and operating the electricity generator), as it is clear from the data in Table (10) that the average costs of production supplies is per thousand chicks during the cycle at the first, second, and third production capacities. It amounted to about 93.78, 92.56, and 84.53 thousand pounds per thousand chicks, respectively, representing about 91.4%, 92.9%, and 93.1%. With an overall average of about 90.65 thousand pounds per thousand chicks, representing about 92.51% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage in the costs of total production requirements was in the third (capacity), followed by the second, and finally the first.**

Variable Costs: Variable costs include both human labor costs and production requirements costs, as data from Table (10) shows that the average variable costs per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 98.23, 97.01, and 89.21 thousand pounds/thousand chicks, respectively, representing About 95.7%, 97.4%, 98.3%. With an overall average of about 95.17 pounds per thousand chicks, representing about 97.12% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage of variable costs was in the third (capacity), followed by the second, and finally the first.**

Fixed Costs (rent): The data in Table (10) indicate that the average farm rent per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 4.43, 2.6, and 1.57 thousand pounds per thousand chicks, respectively, representing about 4.3%, 2.61%, and 1.72%. With an overall average of about 2.82 thousand pounds per thousand chicks, representing about 2.88% of the total costs of the total study sample per thousand chicks. **It is also noted that the highest percentage in the costs of renting the farm was in the first (capacity), followed by the second, and finally the third. Finally, it is noted that the highest percentage in total costs, was in first (capacity), followed by second, and finally third.**

Total Costs: The total costs include both variable costs and fixed costs, as the data in Table (10) shows that the average total costs per thousand chicks during the cycle at the first, second, and third production capacities amounted to about 102.66, 99.61, and 90.77 thousand pounds per thousand chicks, respectively, with a general average. It was about 97.99 per thousand chicks for the total study sample per thousand chicks. **It is also noted that the highest percentage of total costs was in the first (capacity), followed by the second and finally the third.**

Fourth: Analysis of the components of production costs for producing the ton of broiler chicken for different production capacities in the study sample in Gharbia Governorate

Tables (11) and (12) show both the physical and monetary costs of producing the ton of broiler chickens at different production capacities on the farms of the study sample during the production season in 2023, and they will be reviewed as follows:

(1) Human labor: Data in Tables (11), (12) show that the average human labor required to produce a ton of broiler chicken during the cycle at the first, second, and third production capacities amounted to about 0.63, 0.72, and 0.61 men/day, respectively, with a value of 2.32, 2.29. 2.26 thousand pounds, representing about 4.31%, 4.52%, and 5.04%, ranking fourth among the items of total cost for producing a ton of broiler chicken for the three capacities of about 53.78, 50.79, and 44.81 thousand pounds, respectively. With an overall average of about 0.66 men/day, and a value of about 2.29 pounds for the total study sample, representing about 4.58% of the total costs of producing a ton for the total study sample of about 49.95 thousand pounds.

Human labor costs are divided into fixed labor costs and temporary labor, as the data in Table (12) indicates that the average fixed labor costs required to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to 1164.14, 990.14, and 673.64 pounds, representing about 2.16%, 1.95. %, 1.5%, with an overall average of about 950.24 pounds for the total study sample, representing about 1.90% of the total costs of producing a ton for the total study sample.

The data in Table (12) indicate that the average costs of temporary labor required to produce a ton of broiler chicken during the cycle at the first, second, and third production capacities amounted to 1151.24, 1304.56, and 1583.12 pounds, representing about 2.14%, 2.57%, and 3.53%, with an overall

average of about 1339.63 pounds. For the total study sample, it represents about 2.68% of the total costs of producing a ton for the total study sample. From the above, **it is clear that the highest percentage of the total labor costs required to produce a ton of broiler chicken was in the third (Capacity), followed by the second, and finally the first, as a result of the high costs of temporary labor in the third (capacity), and followed by the second and finally the first.**

Table (11): The physical costs of producing a ton of broiler chicken at different production capacities in the study sample in Gharbia Governorate in 2023

Physical costs			Unit	Frist capacity	Second capacity	Third capacity	Total sample
Human labor			man/day	0.63	0.72	0.61	0.66
Production requirements	fodder	Starter fodder	ton	0.408	0.352	0.283	0.349
		growing fodder	ton	0.765	0.825	0.664	0.763
		finishing fodder	ton	0.558	0.510	0.455	0.508
		Total fodder	ton	1.731	1.687	1.402	1.620
	Number of chicks		chicken	529	516	500	515
	amount of bedding		m^3	1.67	1.52	0.95	1.40

First capacity: (3000 chicks or fewer)-Second capacity :(more than 3000- 6000)-Third capacity: (more than 6000) .
Source: Results of analysis of field study data in Gharbia Governorate in 2023.

Table (12) monetary costs for producing a ton of broiler chicken at different production capacities in the study sample in Gharbia Governorate in 2023 (pounds/ton)

Costs			Frist capacity		Second capacity		Third capacity		Total sample	
			costs	%	costs	%	costs	%	costs	%
fixed labor			1164.14	2.16	990.14	1.95	673.64	1.50	950.24	1.90
temporary labor			1151.24	2.14	1304.56	2.57	1583.12	3.53	1339.63	2.68
Total labor			2315.38	4.31	2294.70	4.52	2256.76	5.04	2289.87	4.58
Production requirements	fodder	Starter fodder	7825.84	14.55	6547.71	12.89	6284.17	14.02	6831.80	13.68
		Growing fodder	14705.84	27.35	17161.19	33.79	12410.66	27.70	15143.54	30.32
		finishing fodder	10406.60	19.35	9609.18	18.92	8834.27	19.72	9615.48	19.25
		Total fodder	32938.28	61.25	33318.08	65.61	27529.10	61.44	31590.82	63.25
	chicks		11670.64	21.70	10903.59	21.47	10755.21	24.00	11076.82	22.18
	bedding		665.99	1.24	569.60	1.12	470.29	1.05	568.78	1.14
	Veterinary care		2947.99	5.48	1880.12	3.70	2502.18	5.58	2353.30	4.71
	electricity		311.84	0.58	121.56	0.24	102.66	0.23	169.55	0.34
	Water		98.88	0.18	59.73	0.12	43.65	0.10	66.19	0.13
	Gas		481.34	0.90	256.53	0.51	341.70	0.76	343.33	0.69
	Operate the electricity generator		116.91	0.22	43.01	0.08	23.93	0.05	58.36	0.12
	Total production requirements		49231.87	91.55	47152.22	92.85	41768.72	93.22	46227.15	92.55
Variable costs			51547.25	95.86	49446.92	97.36	44025.48	98.25	48517.02	97.13
Rent			2228.11	4.14	1338.93	2.64	782.08	1.75	1431.99	2.87
Total costs			53775.36	100.00	50785.85	100.00	44807.56	100.00	49949.01	100.00

First capacity: (3000 chicks or fewer) - Second capacity: (more than 3000 - 6000) - Third capacity: (more than 6000).
Source: Results of analysis of field study data in Gharbia Governorate in 2023.

(2) Fodder: Data from tables (11), and (12) indicate that the average total fodder required to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 1.73, 1.69, and 1.4 tons, respectively, with a value of 32.94, 33.32, and 27.53 thousand pounds represent about 61.25%, 65.61%, and 61.44%, ranking first among the total cost items for the three capacities per thousand chicks. With an overall average of about 1.62 tons/thousand chicks, and a value of about 31.59 thousand pounds for the total study sample, representing about 63.3% of the total costs of the total study sample per thousand chicks.

Data from tables (11) and (12) show that the **average starter fodder** required to produce a ton of

broiler chickens during the cycle at the first, second, and third production capacities amounted to about 0.41, 0.35, and 0.28 tons, respectively, with a value of 7.83, 6.55, and 6.28 thousand pounds, representing about 14.55%, 12.89%, 14.02%. With an overall average of about 0.35 tons, and a value of about 13.68 thousand pounds for the total study sample, representing about 6.83% of the total costs for the total study sample.

Data from tables (11) and (12) also show that the **average growing fodder** required to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 0.77, 0.83, and 0.66 tons, respectively, with a value of 14.71, 17.16, and 12.41 thousand pounds, representing about 27.35 tons. %, 33.79%, 27.70%. With an overall average of about 0.76 tons, and a value of about 15.14 thousand pounds for the total study sample, representing about 30.32% of the total costs of the total study sample per thousand chicks.

The data from tables (11) and (12) indicate that the **average finished fodder** required to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 0.56, 0.51, and 0.46 tons, respectively, with a value of 10.41, 9.61, and 8.83 thousand pounds, representing about 19.35, 18.92%, 19.72%. With an overall average of about 0.51 tons/thousand chicks, and a value of about 9.62 thousand pounds/thousand chicks for the total study sample, representing about 19.25% of the total costs for the total study sample. **From the above, it is clear that the highest percentage of the total feed costs was in the second (capacity), followed by the third, and finally the first.**

(3) Chicks: Data from tables (11), (12) indicate that the average number of chicks needed to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 529, 516, and 500 chicks, respectively, with a value of 11.67, 10.90, 10.76 thousand pounds, representing about 21.7%, 21.47%, and 24%, which ranks second among the items of total costs for producing a ton of broiler chickens for the three capacities, with a general average of about 515 chicks, and a value of about 11.08 pounds for the total study sample, representing about 22.18% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage of the costs of chicks was in the third (capacity), followed by the first, and finally the second.**

(4) Bedding: Data from tables (11), and (12) indicate that the average amount of litter needed to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities was about 1.67, 1.52, and 0.95 m^3, respectively, with a value of 666, 569.6, and 470.3 pounds. Representing about 1.24%, 1.12%, and 1.05%, it ranks fifth among the total costs items for producing a ton of broiler chicken for the three capacities. With an overall average of about 1.4 m^3, and a value of about 568.8 pounds for the total study sample, representing about 1.14% of the total costs of producing a ton for the total study sample. **It is noted that the highest percentage of mattress costs was in the first (capacity), followed by the second, and finally the third.**

(5) Veterinary care: Data from Table (12) show that the average farm spending on veterinary care necessary to **produce** a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 2.95, 1.88, and 2.50 pounds, respectively, representing about 5.5%, 3.7%, 5.6%, which ranks third among the total cost items for the three capacities. With an overall average of about 2.35 pounds, it represents about 4.7% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage of the costs of veterinary care was in the third (capacity), followed by the first, and finally the second.**

(6) Electricity: Data from Table (12) indicate that the average farm spending on electricity required to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 311.8, 121.6, and 102.7 pounds, respectively, representing about 0.58%, 0.24%, and 0.23%. It ranks seventh among the total cost items for the three capacities. An overall average of about 169.55 pounds, representing about 0.34% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage of electricity costs was in the first (capacity), followed by the second and finally the third.**

(7) Water: As data in Table (12) shows, the average farm expenditure on water needed to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 98.9, 59.7, and 43.7 pounds, respectively, representing about 0.18%, 0.12%, and 0.10% it ranks eighth among the total cost items for the three capacities. An overall average of about 66.19 pounds, representing about 0.13% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage of water costs was in the first (capacity), followed by the second, and finally the third.**

(8) Gas: As data in Table (12) shows, the average farm spending on gas needed to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 481.3, 256.5, and 341.7 pounds, respectively,

representing about 0.90%, 0.51%, and 0.76% it ranks sixth among the total cost items for the three capacities. An overall average of about 343.3 pounds, representing about 0.69% of the total costs of producing a ton in the total study sample. **It is noted that the highest rate of gas costs was in the first (capacity), followed by the third, and finally the second.**

(9) Operating the electricity generator: As data in Table (12) shows, the average farm expenditure on operating the **electricity** generator necessary to produce a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 116.9, 43.01, and 23.9 pounds, respectively, representing about 0.22%. 0.08%, 0.05%, which ranks ninth among the total cost items for the three capacities. An overall average of about 58.4 pounds, representing about 0.12% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage in the costs of operating the electricity generator was in the first (capacity), followed by the second and finally the third.**

Total production requirements costs:

Data from Table (12) indicate that the average costs of production requirements for producing a ton of broiler chicken during the cycle at the first, second, and third production capacities amounted to about 49.23, 47.15, and 41.77 thousand pounds, respectively, representing about 91.55%, 92.85%, and 93.22%. An overall average of about 46.23 thousand pounds, representing about 92.55% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage in the costs of production requirements was in the third (capacity), followed by the second, and finally the first.**

Variable costs:

Data from Table (12) also indicate that the average variable costs for producing a ton of broiler chicken during the cycle at the first, second, and third production capacities amounted to about 51.55, 49.45, and 44.03 thousand pounds, respectively, representing about 95.9%, 97.4%, and 98.3%. An overall average of about 48.52 pounds, representing about 97.13% of the total costs of producing a ton in the total study sample. **It is noted that the highest percentage of variable costs was in the third (capacity), followed by the second, and finally the first.**

Fixed costs (rent):

Data from Table (12) also indicate that the average farm rent for producing a ton of broiler chickens during the cycle at the first, second, and third production capacities amounted to about 2.23, 1.34, and 0.78 thousand pounds, respectively, representing about 4.14%, 2.64%, and 1.75%. With an overall average of about 1432 pounds, representing about 2.9% of the total costs of producing a ton in the total study sample. It is noted that the highest percentage of the farm rental costs was in the first (capacity), followed by the second, and finally the third. **Finally, it is noted that the highest percentage of total costs was in the first (capacity), followed by the second and finally the third.**

Total costs:

Data from Table (12) indicate that the average total costs of producing a ton of broiler chicken during the cycle at the first, second, and third production capacities amounted to about 53.78, 49.79, and 44.81 thousand pounds, respectively, with an overall average of about 48.95 thousand pounds in the total study sample. **It is noted that the highest percentage of total costs was in the first (capacity), followed by the second and finally the third.**

Fifth: Economic evaluation of the production of broiler chicken farms for different production capacities in the study sample in Gharbia Governorate.

This part deals with a set of economic indicators and standards for the production of broiler farms for different production capacities in the study sample in Gharbia Governorate, which are quantity of meat in tons, total return, the net return, benefit property rights (return over variable costs), benefit-cost ratio, profitability, return on the invested pound, and value-added.

A. Economic evaluation of the production of one thousand chicks in broiler farms for different production capacities in the study sample in Gharbia Governorate:

(1) Quantity of meat: Data in Table (13) indicate that the average quantity of meat produced during the cycle at the three production capacities was estimated at approximately 1.92, 1.95, and 2.03 tons/thousand chicks, respectively, with an overall average of about 1.96 tons. **That is, the highest amount of meat produced from a thousand chicks was in the third (capacity), followed by the second, and finally the first.**

(2) Total return: As the data in Table (13) shows, the average total return during the cycle at the three production capacities was estimated at 139.5, 127.5, and 134.23 thousand pounds per thousand chicks, respectively, with an overall average of about 132.86 thousand pounds, which includes the value of the total return from Selling broiler chickens and selling sepals, **meaning that the highest return from a thousand chicks was in the first (capacity), followed by the third and finally the second, as a result of the high price of a ton of meat and the**

value of the first sabla (capacity), followed by the second and finally the third.

(3) Net return: Data from Table (13) indicate that the average net return during the cycle at the three production capacities was estimated at 36.96, 27.89, and 43.46 thousand pounds per thousand chicks, respectively, with an overall average of about 34.87 thousand pounds. **That is, the highest net return from a thousand chicks was in the third (capacity), followed by the first, and finally the second.**

(4) Profitability: As the data in Table (13) shows, the average profitability during the cycle at the three production capacities was estimated at 26.49%, 21.87%, and 32.37% per thousand chicks, respectively, with an overall average of about 26.25%. **That is, the highest profit from a thousand chicks was in the third (capacity), followed by the first and finally the second, as a result of the high net return for the third category, followed by the first and finally the second.**

(5) Return on the invested pound: As data in Table (13) shows, the average return on the invested pound during the cycle at the three production capacities was estimated at 0.36, 0.28, and 0.48 pounds/thousand chicks, respectively, with an overall average of about 0.36 pounds. **That is, the highest return on the invested pound from a thousand chicks was in the third (capacity), followed by the first and finally the second, as a result of the high net return in the third (capacity), followed by the first and finally the second.**

(6) Benefit-cost ratio: The data in Table (13) indicates that the average cost-return ratio during the cycle at the three production capacities was estimated at 1.36, 1.28, and 1.48 / thousand chicks, respectively, with an overall average of about 1.36. **That is, the highest percentage of return on costs for a thousand chicks was in the third (capacity), followed by the first and finally the second, as a result of the decrease in total costs for the third capacity, followed by the first and finally the second.**

Table (13) Economic indicators per thousand chicks on meat production farms for different production capacities in the study sample in Gharbia Governorate in 2023.

Indicators	Frist capacity	Second capacity	Third capacity	Total sample
Number of dead chickens	20	17	18	18
Number of chickens sold	980	983	982	982
Average weight of the bird (in kg)	1.96	1.98	2.07	2.00
Quantity of meat (tons)	1.92	1.95	2.03	1.96
Price of a ton of meat (in pounds)	71791.70	64654.63	65209.59	66808.40
Total value of meat (in pounds)	137897.50	125839.89	132554.14	131211.70
Quantity of sabla m^3	3.84	4.00	3.96	3.95
The value of the sabla	1603.49	1660.25	1673.37	1648.03
Total return (in pounds)	139500.99	127500.14	134227.51	132859.73
Variable costs (in pounds)	98110.24	97015.41	89206.53	95168.28
Total costs (in pounds)	102544.40	99610.95	90771.62	97990.11
Net return (in pounds)	36956.59	27889.19	43455.89	34869.62
Profitability %	26.49	21.87	32.37	26.25
Return on invested pounds	0.36	0.28	0.48	0.36
Benefit-cost ratio	1.36	1.28	1.48	1.36
Benefit property rights	41390.75	30484.73	45020.98	37691.45
Value added	45839.35	34941.05	49692.81	42205.95

First capacity: (3000 chicks or fewer) - Second capacity: (more than 3000 - 6000) - Third capacity: (more than 6000). **Benefit property rights** or total margin (marginal surplus) = total return – variable costs
Return on invested pounds = (net return / total costs), profitability = (net return / return) x 100
Value added = (total revenue - total production requirements)
Source: Results of analysis of field study data in Gharbia Governorate in 2023.

(7) Benefit property rights (return over variable costs): As the data in Table (13) shows, the average return over variable costs during the cycle at the three production capacities was estimated at 41.39, 30.48, and 45.02 thousand pounds per thousand chicks, respectively, with an overall average of about 37.69 thousand pounds. **That is, the highest return over variable costs from a thousand chicks was in the third (capacity), followed by the first and finally the second, as a result of the decrease in variable costs for the third category, followed by the first and finally the second.**

(8) Value added: The data in Table (13) shows that the value added during the cycle at the three production capacities was estimated at 45.84, 34.94, and 49.69 thousand pounds per thousand chicks, respectively, with an overall average of about 42.21 thousand pounds. **That is, the highest value added from a thousand chicks was in the third (capacity), followed by the first and finally the second, as a result of the decrease in the costs of production requirements for the third capacity, followed by the first and finally the second.**

B. Economic evaluation of the production of one ton of broiler chicken for different production capacities in the study sample in Gharbia Governorate:

(1) Total return: As the data in Table (14) shows, the average total return during the cycle at the three production capacities was estimated at 72.6, 65.5, and 66.05 thousand pounds per ton of meat chicken produced, respectively, with an overall average of about 67.66 thousand pounds, which includes the value of the return per ton from the sale of meat chicken and the sale of sabla. **That is, the highest return per ton was in the first (capacity), followed by the third, and finally the second.**

(2) Ton production costs: Ton production costs: As data in Table (14) shows, the average cost of producing a ton of broiler chicken during the cycle at the three production capacities was estimated at 53.78, 50.79, and 44.81 thousand pounds/ton of broiler chicken produced, respectively, with an overall average of about 49.95. Thousand pounds. **That is, the costs of producing a ton were lower in the third (capacity), followed by the second, and finally the first.**

(3) Net return: The data in Table (14) indicate that the average net return during the cycle at the three production capacities was estimated at approximately 18.87, 14.72, and 21.24 thousand pounds/ton of meat chicken product, respectively, with an overall average of about 17.71 thousand pounds. **That is, the highest Net return per ton was highest in the third (capacity), followed by the first, and finally the second.**

(4) Profitability: As the data in Table (14) shows, the average profitability during the cycle at the three production capacities was estimated at 25.97%, 22.48%, and 32.16% for each ton of meat chicken produced, respectively, with an overall average of about 26.17%. **That is, the highest profitability per ton was in the third (capacity), followed by the first and finally the second, as a result of the high net return per ton in the third (capacity), followed by the first and finally the second.**

Table (14) Economic indicators for producing tons of broiler chickens at different production capacities in meat production farms in the study sample in Gharbia Governorate in 2023 .

Indicators	Frist capacity	Second capacity	Third capacity	Total sample
Number of dead chickens	11	10	9	10
Number of chickens sold	519	506	491	505
Average weight of the bird (in kg)	1.96	1.98	2.07	2.00
Quantity of meat (tons)	1	1	1	1
Price of a ton of meat (in pounds)	71791.70	64654.63	65209.59	66808.40
Total value of meat (in pounds)	2.03	2.06	1.99	2.03
Quantity of sabla m^3	850.27	854.85	838.20	848.91
The value of the sabla	72641.97	65509.48	66047.79	67657.31
Total return (in pounds)	51547.25	49446.92	44025.48	48517.02
Variable costs (in pounds)	53775.36	50785.85	44807.56	49949.01
Total costs (in pounds)	18866.61	14723.63	21240.23	17708.30
Net return (in pounds)	25.97	22.48	32.16	26.17
Profitability %	0.35	0.29	0.47	0.35
Return on invested pounds	1.35	1.29	1.47	1.35
Benefit-cost ratio	21094.72	16062.56	22022.31	19140.29
Benefit property rights	72641.97	65509.48	66047.79	67657.31

First capacity: (3000 chicks or fewer) - Second capacity: (more than 3000 - 6000) - Third capacity: (more than 6000). **Benefit property rights** or total margin (marginal surplus) = total return – variable costs

Return on invested pounds = (net return / total costs), profitability = (net return / return) x 100

Value added = (total revenue - total production requirements)

Source: Results of analysis of field study data in Gharbia Governorate in 2023.

(5) Return on the invested pound: As data in Table (14) shows, the average return on the pound invested during the cycle at the three production capacities was estimated at 0.35, 0.29, 0.47 per ton

of meat chicken produced, respectively, with an overall average of about 0.35. **That is, the highest return for the invested pound per ton was in the third (capacity), followed by the first and finally the second, as a result of the high net return per ton in the third (capacity), and followed by the first and finally the second.**

(6) Benefit-cost ratio: The data in Table (14) indicates that the average benefit-cost ratio during the cycle at the three production capacities was estimated at 1.35, 1.29, and 1.47 per ton of meat chicken produced, respectively, with an overall average of about 1.35. **That is, the highest benefit-cost ratio per ton was in the third (capacity), followed by the first and finally the second, as a result of the decrease in production costs per ton in the third (capacity), followed by the first and finally the second.**

(7) Benefit property rights (return over variable costs): As the data in Table (14) shows, the average return over variable costs during the cycle at the three production capacities was estimated at 21.1, 16.1, and 22.02 thousand pounds per ton of meat chicken produced, respectively, with an overall average of about 19.14 thousand pounds. **That is, the highest return over variable costs per ton was in the third (capacity), followed by the first, and finally the second.**

(8) Value added: The data in Table (18) shows that the value added during the cycle at the three production capacities was estimated at 72.41, 65.51, and 66.05 thousand pounds per ton of meat chicken produced, respectively, with an overall average of about 67.66 thousand pounds. **That is, the value-added per ton, was in the first (capacity), followed by the third, and finally the second.**

Sixth: Estimating and measuring the efficiency of the resources used in producing broiler chickens:

The resources used in broiler production included the number of chicks (chick), the value of the chicks in pounds, the quantity of starter fodder in tons, the value of starter fodder in pounds, the quantity of growing fodder in tons, the value of growing fodder in pounds, the quantity of finishing fodder in tons, the value of finishing fodder in pounds, The number of labor (man/day), the value of labor in pounds, the amount of bedding in cubic meters, and the value of bedding in pounds, which are considered independent variables and which prove to be the most important set of inputs that can affect the dependent variable (Y), which represents the amount of chicken meat per capacity of The three capacities of the study sample farms in Gharbia Governorate for the year 2023.

1- First capacity (3,000 chicks or fewer):

A. Estimating the quantity of actual inputs in the first capacity:

It is clear from Table No. (15) that the average number of chicks was estimated at about 2312.14 chicks, and ranged between a minimum of about 1000 chicks and a maximum of 3000 chicks. The average value of the chicks was about 51402 pounds/cycle, and the amount of starter fodder was about 1.90 tons/cycle. Ranging between a minimum of 0.25 and a maximum of 3.1 tons/cycle. The average total value of starter fodder was about 36237.7 pounds/cycle, and the amount of growing fodder amounted to about 3.06 tons/cycle, ranging between a minimum of one and a maximum of 5 tons/cycle and the average total value of growing fodder was about 58193.9 pounds/cycle, and the amount of finished fodder was about 2.48 tons/cycle, ranging between a minimum of 0.67 and a maximum of 6.19 tons/ cycle, and the average total value of finished fodder was about 45948.75 Pounds/cycle. The number of human Labor was about 3 men/day, ranging from a minimum of 2 men/day to a maximum of 3 men/day, and the average total labor wage was about 9422 pounds/cycle, while the quantity of bedding was about 7.3 m^3, ranging from a minimum of about 0.50 m^3 to the maximum amount was about 15 m^3, and the average total value of the bedding was about 3019 pounds/cycle.

B. Estimating the quantity of optimal production inputs and comparing them to the actual level of broiler chickens in the first capacity:

By comparing the current use of resources with the optimal combination (the point at which the ISO Cost line touches the ISO Production curve) of the same resource, as shown in Table (15), it was found that there was a waste of the quantities of resources used in the production process for this capacity, and those quantities were estimated. Wasted resources: the number of chicks per chick is about 31 chicks, starting fodder (tons/cycle) is about 0.299 tons/cycle, growing fodder (tons/cycle) is about 0.021 tons/cycle, finishing fodder (tons/cycle) is about 0.026 tons/cycle. Cycle, human labor (man/day) is about 0.001 man/day, bedding (m^3) is about 0.091 m^3, where the amount of waste from each resource represents, respectively, about 1.36%, 12.5%, 0.69%, 1.05%, 0.04%, and 1.24. % of the actual quantities used in production. In order for the farm to achieve full economic efficiency at the current level, the amount of actual resources must be reduced according to the value of the economic efficiency index.

2- The second capacity (more than 3000-6000):

A. Estimating the quantity of actual production inputs in the second capacity

It is clear from Table No. (16) That the average number of chicks was estimated at about 4745.83 chicks, ranging between a minimum of about 3250 chicks and a maximum of 6000 chicks. The average value of the chicks was about 100112.31 pounds/cycle, and the amount of starter fodder was about 3.2 tons/cycle ranging between a minimum of 1 and a maximum of 10.5 tons/cycle. The average total value of the starting feed was about 60291.6 pounds/cycle, and the amount of growing fodder was about 7.8 tons/cycle ranging between a minimum of one and a maximum of 13.5 tons/cycle, and the average total value of growing fodder was about 164303.6 pounds/ cycle, and the amount of finished fodder was about 4.74 tons/cycle, ranging between a minimum of 1.63 and a maximum of 8 tons/cycle, and the average total value of finished fodder was about 90620.5 pound/cycle, and the number of human Labor was about 7 men/day, ranging from a minimum of 4 men/day to a maximum of 10 men/day. The average total labor wage was about 21233.86 pounds/cycle, while the quantity of bedding reached about 13.82 m3, ranging from Between a minimum of about 7.5 m3 and a maximum of about 10 m3, the average total value of the bedding was about 5274 pounds/cycle.

B. Estimating the quantity of optimal production inputs and comparing them to the actual level of broiler chickens in the second capacity:

By comparing the current use of resources with the optimal combination (the point at which the ISO Cost line touches the ISO Production curve) of the same resource, as shown in Table (16), it was found that there was a waste of the quantities of resources used in the production process for this capacity, and those quantities were estimated. Wasted resources: the number of chicks per chick is about 7 chicks, starting fodder (tons/cycle) is about 0.008 tons/cycle, growing fodder (tons/cycle) is about 0.052 tons/cycle, finishing fodder (tons/cycle) is about 0.118 tons/cycle. Human labor (man/day) is about 0.100 men/day, bedding (m^3) is about 0.334 m^3, where the amount of waste from each resource represents, respectively, about 0.140%, 0.25%, 0.66%, 2.49%, 1.49%, and 3.21%. Of the actual quantities used in production, and in order for the farm to achieve full economic efficiency at the current level, the amount of actual resources must be reduced according to the value of the economic efficiency index.

Table (15): The actual and optimal mix of resources used in the production of broiler chickens in the first capacity farms (3000 chicks or fewer) in the study sample in Gharbia Governorate in 2023 using the data envelope (DEAP).

Variable		Input			The value
		Mean	Max.	Min.	
Number of chicks (one)	Original	2312.14	3000	1000	51401.57
	Targets	2280.71	2839.89	1000	
	Slacks	31.435	160.114	0.00	
	(%)Slacks	1.36	5.34	0.00	
Starter fodder (tons/cycle)	Original	1.90	5.33	0.25	36237.66
	Targets	1.67	3.1	0.25	
	Slacks	0.229	2.450	0.00	
	(%)Slacks	12.05	45.97	0.00	
Growing fodder (tons/cycle)	Original	3.06	5	1	58193.93
	Targets	3.04	4.797	1	
	Slacks	0.021	0.203	0.00	
	(%)Slacks	0.69	4.06	0.00	
Finished fodder (tons/cycle)	Original	2.48	6.19	0.67	45948.75
	Targets	2.45	5.865	0.67	
	Slacks	0.026	0.325	0.00	
	(%)Slacks	1.05	5.25	0.00	
Labor (men/day)	Original	2.57	3	2	9422.14
	Targets	2.57	2.989	2	
	Slacks	0.001	0.011	0.00	
	(%)Slacks	0.04	0.37	0.00	
Bedding quantity (m^3/cycle)	Original	7.31	15	0.50	3018.63
	Targets	7.219	14.893	0.50	
	Slacks	0.091	0.107	0.00	
	(%)Slacks	1.24	0.71	0.00	

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

Table (16): The actual and optimal mix of resources used in the production of broiler chickens in the second capacity farms (more than 3000 - 6000 chicks) in the study sample in Gharbia Governorate in 2023 using the data envelope (DEAP).

Variable		Input			The value
		Mean	Max.	Min.	
Number of chicks (one)	Original	4745.83	6000	3250	100112.31
	Targets	4739.19	5854.977	3250	
	Slacks	6.642	145.023	0.00	
	(%)Slacks	0.140	2.417	0.00	
Starter fodder (tons/cycle)	Original	3.2	10.5	1	60291.61
	Targets	3.192	10.403	1	
	Slacks	0.008	0.097	0.00	
	(%)Slacks	0.25	0.924	0.00	
Growing fodder (tons/cycle)	Original	7.82	13.5	1	164303.61
	Targets	7.768	12.771	1	
	Slacks	0.052	0.729	0.00	
	(%)Slacks	0.66	5.4	0.00	
Finished fodder (tons/cycle)	Original	4.74	8	1.63	90620.45
	Targets	4.622	7.153	1.63	
	Slacks	0.118	0.847	0.00	
	(%)Slacks	2.489	10.59	0.00	
Labor (men/day)	Original	6.73	10	4	21233.86
	Targets	6.63	8.627	4	
	Slacks	0.100	1.373	0.00	
	(%)Slacks	1.49	13.73	0.00	
Bedding quantity (m^3/cycle)	Original	13.82	20	7.5	5274.09
	Targets	13.377	11.42	7.5	
	Slacks	0.443	1.752	0.00	
	(%)Slacks	3.21	8.76	0.00	

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

3- The third capacity (more than 6000):

A. Estimating the quantity of actual production inputs in the third capacity:

It is clear from Table (17) That the average number of chicks was estimated at about 11662 chicks, ranging between a minimum of about 6500 chicks and a maximum of 18000 chicks. The average value of the chicks was about 240266 (pounds/cycle), and the amount of starter fodder was about 6.5 (tons/cycle) ranging between a minimum of 4 and a maximum of 32 tons/cycle. The average total value of starter fodder was about 144782.7 pounds/cycle, and the amount of growing fodder was about 14.95 (tons/cycle) ranging between a minimum of 3.7 and a maximum of 21.3 tons/cycle, and the average total value of growing fodder was about 282165.5 pounds/cycle, and the amount of finished fodder was about 10.25 (tons/cycle), ranging between a minimum of 4 and a maximum of 20 tons/cycle, and the average total value of finished fodder was about 199646. 5 pounds/cycle, and the number of human Labor was about 13 (men/day), ranging from a minimum of 12 men/day to a maximum of 14 men/day. The average total labor wage was about 47417.9 pounds/cycle, while the amount of bedding reached about 20.69 m^3, ranging

from Between a minimum of about 10.5 m^3 and a maximum of about 30 m3, the average total value of the bedding was about 9988.8 pounds/cycle.

B. Estimating the quantity of inputs for optimal production and comparing it to the actual level of broiler chickens in the third capacity:

By comparing the current use of resources with the optimal combination (the point at which the ISO Cost line touches the ISO Production curve) of the same resource, as shown in Table (17), it was found that there was a waste of the quantities of resources used in the production process for this capacity, and those quantities were estimated. Wasted resources of the number of chicks per chick are about 148 chicks, starting fodder (tons/cycle) is about 1.800 tons/cycle, growing fodder (tons/cycle) is about 0.263 tons/cycle, finishing fodder (tons/cycle) is about 0.430 tons/cycle. Human labor (man/day) is about 0 man/day, bedding (m^3) is about 0.845 m^3, where the amount of waste from each resource represents, respectively, about 1.27%, 27.82%, 1.76%, 4.20%, 0%, 4.08% of the actual quantities used in production, and in order for the farm to achieve full economic efficiency at the current level, the amount of actual resources must be reduced according to the value of the economic efficiency index.

From the above it is clear that there are no amounts of wasted labor for this capacity.

Table (17): The actual and optimal mix of resources used in the production of broiler chickens in the third capacity farms (more than 6000 chicks) in the study sample in Gharbia Governorate in 2023 using the data envelope (DEAP).

Variable		Input			The value
		Mean	Max.	Min.	
Number of chicks (one)	Original	11662.14	18000	6500	240266.1
	Targets	11513.7	16218.26	6500	
	Slacks	148.44	1781.74	0.00	
	(%)Slacks	1.27	9.90	0.00	
Starter fodder (tons/cycle)	Original	6.47	32	4	144782.7
	Targets	4.67	6.96	4	
	Slacks	1.800	25.04	0.00	
	(%)Slacks	27.82	78.25	0.00	
Growing fodder (tons/cycle)	Original	14.95	21.3	3.7	282165.5
	Targets	14.687	17.623	3.7	
	Slacks	0.263	3.677	0.00	
	(%)Slacks	1.759	17.26	0.00	
Finished fodder (tons/cycle)	Original	10.25	20	4	199646.5
	Targets	9.82	16.92	4	
	Slacks	0.430	3.080	0.00	
	(%)Slacks	4.195	18.20	0.00	
Labor (men/day)	Original	12.93	14	12	47417.86
	Targets	12.93	14	12	
	Slacks	0.00	0.00	0.00	
	(%)Slacks	0.00	0.00	0.00	
Bedding quantity (m^3/cycle)	Original	20.69	30	10.5	9988.83
	Targets	19.845	23.764	10.5	
	Slacks	0.845	6.236	0.00	
	(%)Slacks	4.08	26.24	0.00	

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

Seventh: Technological efficiency and capacity efficiency of broiler chickens in Gharbia Governorate:

1. **Technological efficiency and capacity efficiency of broiler chickens in Gharbia Governorate in the first capacity:**

Table No. (18) Shows the results of the analysis for both technical efficiency and capacity efficiency, according to both the constant return of scale (CRS) and the variable return of scale (VRS), as well as capacity efficiency.

According to the **concept of constant return of scale (CRS)**, which assumes that the farm is exploited and operated at its maximum capacity, the results of Table No. (18) Indicate that only 8 farms are technically efficient, at a rate of 57.14% of the total of the first capacity (3000 chicks or fewer), which amounts to about 14 farms. While about 6 farms, representing about 42.86% of the farms in this capacity, are technically inefficient, and their technical efficiency ranged between 77.2% and 100%, with an average of 96%, which means that the same level of production can be achieved using only 96% of the actual combination of resources used. That saves about 4% of resources without affecting the production level.

Table (18): Technical efficiency and scale efficiency of first capacity farms (3000 chicks or fewer) for broiler chickens in the cycle in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Scale Efficiency	Technical Efficiency		Statistics
	VRS	CRS	
0.772	0.969	0.772	**Min**
1.00	1.00	1.00	**Max**
0.963	0.997	0.960	**Mean**
			Return on capacity
8	12	8	**Efficiency=1**
2	—	—	**Drs**
4	—	—	**Irs**

The number of cycle days is 45 days and cleaning is 15 days. -The number of cycles per year is 6 cycles.

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

It was observed that the technical efficiency in the **variable return of scale (VR)** (assuming that these farms are not operating at maximum capacity) increased to about 99.7% on average, as it ranged between 96.9% and 100%. Hence, these farms can increase their production by about 0.3% with the same amount of production factors. It was also shown that the number of technically efficient farms in the variable return of scale increased to 12 farms, representing about 75% of the total first-capacity farms. The actual combination used by these farms is considered three-quarters of the optimal combination, which means the necessity of increasing the production of these farms above the level of Their current production and working to increase the technical efficiency of farms with a decreasing return of scale in that production capacity.

As for **scale efficiency**, the average in this capacity was about 96.3%, with a minimum of about 77.2% and a maximum of 100%. The results also showed that 4 farms had increasing scale efficiency, **which means that with increased production, costs increase to a lesser extent than production**, which necessitates increasing the quantities of resources used in the production process, while 2 farms were found to have decreasing scale efficiency, **which means that as production decreases, costs increase with a greater amount of production**, and about 8 efficient farms.

2. **Technological efficiency and capacity efficiency of broiler chickens in Gharbia Governorate in the second capacity:**

Table No. (19) Shows the results of the analysis for both technical efficiency and capacity efficiency, according to both the constant return of scale (CRS) and the variable return of scale (VRS), as well as capacity efficiency.

According to **the concept of constant return of scale (CRS)**, which assumes that the farm is exploited and operated at its maximum capacity, the results of Table No. (19) Indicate that only 11 farms are technically efficient, representing 50% of the total of the second capacity (more than 3000-6000 chicks), which is about 22 farms. While about 11 farms, representing about 50% of the farms in this capacity, are technically inefficient, and their technical efficiency ranged between 88.4% and 100%, with an average of 97.5%, which means that the same level of production can be achieved using only 97.5% of the actual combination of resources used. That saves about 2.5% of resources without affecting the production level.

It was observed that the technical efficiency in the **variable return of scale (VRS)** (assuming that these farms are not operating at maximum capacity) increased to about 98.5% on average, as it ranged between 88.5% and 100%. Hence, these farms can increase their production by about 1.5% with the same amount of production factors. It was also shown that the number of technically efficient farms in the variable return of scale has increased to 16 farms, representing about 72.7% of the total second-

capacity farms. The actual combination used by these farms is less than the optimal combination, which means the necessity of increasing the production of these farms above their current production level. And working to increase the technical efficiency of farms with a decreasing return of scale in that production capacity.

As for **scale efficiency**, the average in this capacity was about 99%, with a minimum of about 89.6% and a maximum of 100%. The results also showed that 8 farms had increasing scale efficiency, **which means that with increasing production, costs increase to a lesser extent than production**, which necessitates increasing the quantities of resources used in the production process, while 3 farms were found to have decreasing capacity efficiency, **which means that as production decreases, costs increase to a greater extent than production**, and about 11 farms are efficient.

Table (19): Technical efficiency and scale efficiency of second capacity farms (More than 3000-6000 chicks) for broiler chickens in the cycle in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Scale Efficiency	Technical Efficiency		Statistics
	VRS	CRS	
0.896	0.885	0.884	**Min**
1.00	1.00	1.00	**Max**
0.990	0.985	0.975	**Mean**
			Return on capacity
11	16	10	**Efficiency=1**
3	—	—	**Drs**
8	—	—	**Irs**

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

3. Technological efficiency and capacity efficiency of broiler chickens in Gharbia Governorate in the third capacity:

Table No. (20) Shows the results of the analysis for both technical efficiency and capacity efficiency, according to both the constant return of scale (CRS) and the variable return of scale (VRS), as well as capacity efficiency.

According to **the concept of constant return on capacity (CRS)**, which assumes that the farm is exploited and operated at its maximum capacity, the results of Table No. (20) Indicate that only 8 farms are technical efficiency, representing 57.14% of the total third holding capacity (more than 6000 chicks), which amounts to about 14 farms. While about 6 farms, representing about 42.86% of the farms in this capacity, are technically inefficient, and their technical efficiency ranges between 82.9% and 100%, with an average of 95%, which means that the same level of production can be achieved using only 95% of the actual combination of resources used. That saves about 5% of resources without affecting the production level.

It was observed that the technical efficiency in **the variable return of scale (VRS)** (assuming that these farms are not operating at maximum capacity) increased to about 99% on average, as it ranged between 92.5% and 100%. Hence, these farms can increase their production by about 1% with the same amount of production factors. It was also shown that the number of farms that are technically efficient in the variable return of scale has increased to 11 farms, representing about 78.57% of the total third-capacity farms. The actual combination used by these farms is less than the optimal combination, which means the necessity of increasing the production of these farms above their current production level. And work to increase the technical efficiency of farms with a decreasing return of scale in this production capacity.

As for **scale efficiency**, the average in this capacity was about 96%, with a minimum of about 83.5% and a maximum of 100%. The results also showed that 6 farms had increasing scale efficiency, **which means that with increasing production, costs increase to a lesser extent than production**, which necessitates increasing the quantities of resources used in the production process, while no farm achieves the efficiency of the decreasing capacity, and about 8 farms are efficient.

Table (20): Technical efficiency and scale efficiency of third capacity farms (More than 6000 chicks) for broiler chickens in the cycle in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Scale Efficiency	Technical Efficiency		Statistics
	VRS	CRS	
0.837	0.925	0.829	**Min**
1.00	1.00	1.00	**Max**
0.960	0.990	0.951	**Mean**
			Return on capacity
8	11	8	**Efficiency=1**
0	—	—	**Drs**
6	—	—	**Irs**

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

Eighth: Distribution efficiency, production efficiency, and costs for broiler chickens in Gharbia Governorate:

1. First capacity:

By reviewing the data in Table No. (21), it was found that **the distribution efficiency** of farms of the first holding capacity (3000 chicks or less) for broiler chickens amounted to about 75.5% as a minimum and about 100% as a maximum, with an average of about 82%, which indicates that when redistributing the economic resources used in production Broiler chickens with the first holding capacity will save 18% of their production costs at the estimated production level for these farms. This occurs when the point of contact (equilibrium) moves between the ISO Production curve and the ISO Cost line.

While the number of efficient farms was about 1 farm, meaning that the farm is the one operating at the optimal combination of production, the results showed that about 8 farms had achieved full **production efficiency** (one is correct) of their used resources at a rate of 57.14%, while the minimum and maximum were estimated by about 77.2%: 100%, with an average of 96%.

About 1 farm has achieved full **economic efficiency (cost efficiency)**, with a minimum of 60.5% and a maximum of 100%, with an average of 78.8%, which means that the producers of these farms can achieve the optimal volume of production while reducing total production costs by 21.2% of Costs of resources currently used.

Table (21): Distributional efficiency, productivity and costs of first capacity farms (3000 chicks or less) per cycle for broiler chickens in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Cost Efficiency	AL locative Efficiency	Technical Efficiency	Statistics
0.605	0.755	o.772	**Min**
1.00	1.00	1.00	**Max**
0.788	0.821	0.960	**Mean**
1	1	8	**Efficiency=1**

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

2. Second capacity:

By reviewing the data in Table No. (22), it was found that the **distribution efficiency** of the second capacity farms (more than 3000-6000 chicks) for broiler chickens amounted to about 74.9% at a minimum and about 100% at a maximum, with an average of about 88.6%, which indicates that when redistributing the economic resources used in producing broiler chickens with the second holding capacity, it will save 11.4% of its production costs at the estimated production level for these farms. This occurs when the point of contact (equilibrium) moves between the ISO Production curve and the ISO Cost line.

While the number of efficient farms was about 1 farm, meaning that the farm is the one operating at the optimal combination of production, the results showed that about 10 farms had achieved full **production efficiency** (one is correct) of their used resources at a rate of 45.45%, while the minimum and highest limits were estimated. By approximately 88.4%: 100%, with an average of 97.5%.

About 1 farm has achieved full **economic efficiency (cost efficiency)**, with a minimum of 74.5% and a maximum of 100%, with an average of 86.3%, which means that the producers of these farms can achieve the optimal volume of production while reducing total production costs by 13.7% of Costs of resources currently used.

Table (22): Distributional efficiency, productivity and costs of second capacity (More than 3000 - 6000 chicks) per cycle for broiler chickens in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Cost Efficiency	AL locative Efficiency	Technical Efficiency	Statistics
0.749	0.749	0.884	**Min**
1.00	1.00	1.00	**Max**
0.863	0.886	0.975	**Mean**
1	1	10	**Efficiency=1**

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

3. Third capacity:

By reviewing the data in Table No. (23), it was found that the **distribution efficiency** of the third capacity farms (more than 6000 chicks) for broiler chickens amounted to about 58.5% as a minimum and about 100% as a maximum, with an average of about 79%, which indicates that when redistributing the economic resources used in producing chickens Meat at the third capacity will save 21% of its production costs at the estimated production level for these farms. This occurs when the point of contact (equilibrium) moves between the

symmetrical production curve and the symmetrical cost line.

While the number of efficient farms was about 1 farm, meaning that the farm is the one operating at the optimal combination of production, the results showed that about 8 farms had achieved full **production efficiency** (one is correct) of their used resources at a rate of 57.14%, while the minimum and maximum were estimated by approximately 82.9%: 100%, with an average of 95%.

About 1 farm has achieved full **economic efficiency (cost efficiency)**, with a minimum of 58.5% and a maximum of 100%, with an average of 75%, which means that the producers of these farms can achieve the optimal volume of production while reducing total production costs by 25% of Costs of resources currently used.

Table No. (23): Distributional efficiency, productivity and costs of third capacity (more than 6000 chicks) per cycle for broiler chickens in Gharbia Governorate in 2023 using the data envelopment method (DEA)

Cost Efficiency	AL locative Efficiency	Technical Efficiency	Statistics
0.585	0.585	0.829	**Min**
1.00	1.00	1.00	**Max**
0.750	0.790	0.951	**Mean**
1	1	8	**Efficiency=1**

Source: Collected and calculated from: Results of analyzing data for the study sample in Gharbia Governorate in 2023 using the DEAP program.

Recommendations

1- It is necessary to increase the production of the three farms' production capacities above their current production level, as the actual combination used by these farms is less than the optimal combination.

2- Focus on operating farms with third production capacities (more than 6,000 chicks), as it has been shown that these are the most resource-saving capacities. The same amount of production can be obtained by saving 5% of the resources used in the production process.

3- Ensure that production is increased for the second production capacity (more than 3,000 chicks - 6,000), as it has been shown that it is the capacity with the highest increase in production, so production can be increased by 1.5% with the same amount of production elements used in the production process.

4- Working to reduce the total production costs for the three production capacities by 21.2%, 13.7%, and 25% of the costs of the resources currently used, respectively, to achieve the optimal volume of production for these farms.

5- Encouraging breeders to increase the number of poultry in the sheds in order to achieve savings in production capacity, which increases farm revenues.

6- Encouraging breeders to invest in the poultry production sector by providing them with the necessary financing at a small interest rate by activating the role of agricultural policies in this field.

7- Providing production requirements at reasonable prices, especially feed and energy sources, and providing trained technical workers in the field of the poultry industry.

8- Providing good breeds of chicks at reasonable prices and appropriate veterinary supervision by specialists may be among the methods for promoting broiler chicken production farms.

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