An Economic Study of the Production and Manufacturing of Papyrus Papers in Al-Sharkia Governorate

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Abstract: One of the earliest plants to be cultivated since the Pharaonic era is papyrus. In Al-Sharkia Governorate, papyrus is grown in the village of Al-Qaramous. Al-Qaramous is known for its high-quality papyrus papers. This sector supports employment opportunities and economic growth, making it one of the main industries in the Al-Sharkia Governorate. Due to the various challenges facing the papyrus paper industry in the Al-Sharkia Governorate, this study intends to perform an economic analysis of the production and manufacturing of papyrus papers, from cultivation to manufacturing to the final product of papyrus papers. Data was collected through personal interviews with farmers and producers of papyrus papers for the agricultural season 2022–2023. The study's research methodology consists of two analytical techniques: descriptive and quantitative. The study used the Tripartite Decomposition Analysis model to study the impact of the papyrus crop's cultivated area, productivity per feddan, and farm price on crop production value over three periods. The cultivated area had the highest impact rate of 52.20% for all the individual and common factors in the first period (pre-January 25 revolutions) (2000–2010). The combined impact of the cultivated area and the average productivity per feddan reached 91.20%, representing the highest impact of the combined factors in the second period (post-January 25 revolution) (2011–2016). The farm price had the highest impact on the individual factors, with an increase of 56.69% in the production value of the papyrus crop in the third period (exchange rate liberalization) (2017–2023). There are two methods for producing papyrus, and each has a different set of raw materials, production processes, and cost. Out of the total papyrus paper production in the field study sample, the workshop produces 75% of its paper using the first method (light) and 25% using the second method (dark). It is evident that all estimated efficiency indicators are positive and show the availability of benefits, which motivates producers to carry out more projects. One of the biggest challenges is product marketing. Encouraging producers to sell their products both domestically and abroad will increase the competitiveness of papyrus products, according to producers' suggestions for problem solutions.

Introduction:

Papyrus is one of the oldest plants cultivated since the Pharaonic era to the present, where it was used to register the Pharaonic civilization in that period. One of the only villages in Egypt known for producing papyrus papers is Al-Qaramous, located in Abu Kabeer Center within Al-Sharkia Governorate. Papyrus was first known in 1977. The cultivation of papyrus is considered one of the most important agricultural activities in Al-Sharkia Governorate. Plants' stems are used for the production of papyrus papers. Papyrus is characterized by its ability to remain in the soil for fifteen years or more. It needs clay soil and good moisture. It also requires special care during harvesting and manufacturing to obtain high-quality papers known for their flexibility, durability, and good ink absorption, which are used in printing and writing. The village of Al-Qaramous in Al-Sharkia Governorate is known for its high-quality papyrus papers. It is a distinctive village in its production and manufacturing, and it plays a significant role in meeting the needs of both local and international markets. Overall, this industry is regarded as one of the essential industries in Al-Sharkia Governorate, contributing to economic development and employment opportunities. It serves as a primary source of export revenues. Supporting and growing this industry can lead to economic growth on both a personal and a national level.

Research problem:

The papyrus paper industry in Al-Sharkia Governorate faces several obstacles, such as the underutilization of available resources and modern technology, leading to adverse impacts on product quality and cost. Moreover, there is a shortage of skilled laborers and experts essential for enhancing productivity and quality. Furthermore, producers encounter challenges in marketing paper both

domestically and internationally. Despite the high value and substantial global demand for papyrus papers, it lacks adequate and suitable marketing strategies to attract consumers.

Research Objectives:

The study aims to conduct an economic analysis of the production and manufacturing of papyrus papers in the Governorate of Al-Sharkia, starting from its cultivation through its manufacturing until obtaining papyrus papers, and to identify the problems and challenges facing papyrus farmers and producers, as well as the measures and proposals to develop this industry.

Data Sources and Research Methodology:

The study used two sources of data: primary data from a field sample of thirty farmers in the village of Al-Qaramous, Abu Kabeer Center, in the Governorate of Al-Sharkia, and secondary data from the Ministry of Agriculture and Land Reclamation. Data was collected through personal interviews with farmers and producers of papyrus papers for the agricultural season 2022–2023. The study's research methodology is based on two analytical techniques. The descriptive method uses growth rates, averages, and relative importance. The quantitative method uses farm budget analysis and tripartite decomposition analysis. And derivative several economic efficiency indicators, such as total margin over variable costs, net income, producer surplus, and product margin.

Results and Discussion:

The development of the cultivated area, productivity, and production of papyrus plants:

By analyzing the data in Table (1) regarding the cultivated area of papyrus plants, the productivity per feddan, and the total production of the crop in the Governorate of Al-Sharkia, the results were as follows: The average cultivated area reached approximately 141.29 feddan, while the average productivity per feddan was about 22.27 tons, and the average total production was approximately 3132.70 tons. The maximum cultivated area during the study period (2000–2023) reached about 375 feddan in 2011, while the minimum for the same period was about 30 feddan in 2017. The growth rate for the cultivated area was approximately 0.78%. As for the maximum productivity per feddan of papyrus plants, it was about 27 tons in 2023, while the minimum was about 3 tons in 2017, with a growth rate of approximately 0.47%. The maximum total production reached about 5520.8 tons in 2005, while the minimum was about 90 tons in 2017, with a growth rate of approximately 1% during the study period (2000–2023). In order to measure the annual growth rate, the exponential function was used. Equation number (1) is as follows: $Y_t = Y_0 e^{rt}$ from which we can

deduce equation number (2): $r = \frac{Ln(Y_t - LnY_0)}{T}$ where r = the annual growth rate of variable Y, Yt = the value in year t, Y0 = the value in the base year, T = the number of years between (t, 0), and Ln = natural logarithm.

Table (1): Cultivated Area, Productivity per feddan, and Total Production of Papyrus Crop in Al-Qaramous Village, Al-Sharkia Governorate, during the period 2000–2023.

Year	Cultivated Area in feddan	Productivity per feddan in tons	Total Production in tons
2000	117	24.1	2820
2001	142	26.92	3823
2002	163	26.93	4390
2003	152	26.96	4098
2004	182	26.85	4887
2005	206	26.8	5521
2006	181	26.81	4853
2007	173	26.79	4635
2008	102	25.47	2598
2009	178	26.91	4790
2010	197	26.6	5240
2011	375	8.67	3251
2012	270	8.86	2392
2013	50	9	450
2014	71	8.98	637.58
2015	80	24	1920
2016	96	26.97	2589
2017	30	3	90
2018	53	24	1272
2019	99	26.8	2653
2020	119	26.98	3211
2021	91	24	2184
2022	123	25	3075
2023	141	27	3807
Average	141.29	22.27	3132.7
Max	375	27	5520.8
Min	30	3	90
Rate%	0.78	0.47	1

Source: Collected and calculated from the Summer Agricultural Statistics and the Nile Crops Bulletin, multiple editions.

Based on the previous results, the factors affecting the production value of the papyrus crop will be studied using the tripartite decomposition analysis model in the next section. Its purpose is to clear fluctuations in the area, productivity, and production value of the papyrus crop during the study period and identify the reasons for this variation.

Factors impacting papyrus crop value:

This section uses the Tripartite Decomposition Analysis model (Equation (1)) to study the impact of the papyrus crop's cultivated area, productivity per

feddan, and farm price on crop production value over three time periods: the first (pre-January 25 revolution) (2000–2010), the second (post January 25 revolution) (2011–2016), and the third (exchange rate liberalization) (2017–2023). An analysis is applied both individually and collectively. To calculate the difference in the crop production value between two periods, vto and vti, the value of the papyrus crop v in year t is estimated by multiplying the total cultivated area in feddan (A) by the average productivity per feddan in tons (Y) by the average farm price per ton (P), as follows:

$$V_{(t)} = A_{(t)} \cdot Y_{(t)} \cdot P_{(t)}$$

Therefore, any change in the value of the production of the **papyrus** crop (Δvi) between two periods to, ti can be measured by the following equation: (Alpha C. Chiang, 1972)

$$\Delta v_i = v_i (t_i) - v_i (t_o)$$

$$\Delta v_i = \Delta AP_o Y_o + \Delta PA_o Y_o + \Delta YP_o A_o + \Delta A\Delta PY_o + \Delta Y\Delta PA_o + \Delta A\Delta YP_o + \Delta A\Delta P\Delta Y \quad .... (1)$$

Where:

$\Delta AP_o Y_o$ = The total effect of cultivated area, $\Delta PA_o Y_o$ = The average Farm price effect, $\Delta YP_o A_o$ = The average productivity per feddan effect, $\Delta A\Delta PY_o$ = The Cultivated area and The farm price effects, $\Delta Y\Delta PA_o$ = The productivity per feddan and The Farm price effects, $\Delta A\Delta YP_o$ = The Cultivated area and the productivity per feddan effects, $\Delta A\Delta P\Delta Y$ = The Farm price, the total cultivated area and the productivity per feddan effect

It must be clarified that any component of the right-hand side of the equation can be defined as a percentage ratio of the dependent variable Δvi.

The Tripartite Decomposition Analysis results for the following factors are shown in Table (2): the first period (pre-January 25 revolution) (2000–2010), the second period (post-January 25 revolution) (2011–2016), and the third period (exchange rate liberation) (2017–2023). The factors include cultivated area, productivity per feddan, farm price, and their combined effects on the value of papyrus crop production during the period (2000–2023), as follows:

Tripartite Decomposition Analysis for the Total Period (2000–2023):

During this period, the highest impact rate was attributed to the total cultivated area, resulting in a 113.21% increase in the value of papyrus crop production. Subsequently, the impact of the farm price increased by 56.34%. Subsequently, the impact of the average productivity per feddan increased by approximately 36.56%, representing the lowest impact of individual factors and reducing the crop's value. Meanwhile, the combined impact of factors was as follows: The overall impact of the farm price, the total cultivated area, and the average productivity per feddan reached 38.92%, representing the highest impact of the combined factors. As for the impact of the remaining factors, it led to a reduction in the production value, but with varying ratios. The impact of the cultivated area and the average productivity per feddan contributed 3.06%. Subsequently, the impact of the average productivity per feddan and the farm price increased

by 29.90%, and finally, the impact of the cultivated area and the farm price increased by 38.96%.

Tripartite Decomposition Analysis for the First Period (Pre-January 25 Revolution) (2000–2010):

During this time, it was clear that the cultivated area had the highest impact rate (52.20% of all the individual factors) as an increase in the papyrus crop's production value. This emphasizes how important the area is for a crop like papyrus, which can stay in the ground for up to 15 years and only needs to be serviced once when it first starts to grow. Subsequently, the impact of the farm price increases the production value by 38.65%. At that time, there was a correlation between this and both the stability of tourism and the demand for papyrus crops in order to produce papyrus papers. Then, the impact of the average productivity per feddan by approximately 3.09%, representing the lowest impact of the individual factors, is attributed to the link between productivity and actual plant mowing. Here, productivity is reflected in the longer mowing times needed for papyrus papers, which rise with demand for the product. However, its impact is less due to the high impact of both price and productivity, while the impact of the common factors was as follows: the impact of the cultivated area and the average productivity per feddan by 6.65%, representing the highest impact of the common factors, followed by the overall impact of the farm price, the total cultivated area, and the average productivity per feddan by 0.46%. Subsequently, the impact of the average productivity per feddan and the farm price decreased by 0.02%, and finally, the negative impact of the total cultivated area and the farm price led to a decrease in the production value by 1.08%.

Tripartite Decomposition Analysis for the Second Period (Post-January 25 Revolution) (2011-2016):

It was found that, of all the individual factors, the average productivity per feddan had the highest impact rate during this period, increasing the production value of the papyrus crop by 79%. Then, the impact of the farm price increased the production value by 40.22%. The impact of the cultivated area resulted in a reduction in the production value by approximately 86.15%, representing the lowest impact of the individual factors. It is attributed to the security and political disturbances that followed the January revolution, which negatively impacted the tourism industry and were essential for the marketing of papyrus paper products. In addition, the farmers' sense of unease prevented them from harvesting the crop because they were afraid that criminals and fugitives might conceal themselves among the crops. Some also refrained from cultivation in the subsequent years within the same period, turning to rice cultivation due to the similarities in agricultural conditions. The increasing impact of price and productivity supports this theory. The combined impact of the cultivated area and the average productivity per feddan reached 91.20%, representing the highest impact of the combined factors, followed by the combined impact

of the cultivated area and the farm price. Then the negative impact on the production value is due to the overall impact of the farm price, the cultivated area, and the average productivity per feddan of 19.08%.

Finally, the negative impact of the average productivity per feddan and the farm price resulted in a decrease in the production value by 22.27%.

Table (2): Tripartite Decomposition Analysis of the Effects of the Factors of Cultivated Area, Productivity per Feddan, and Farm Price on the Value of Papyrus Crop Production during the Period 2000–2023.

Factors	Impact rate (%) for the first period (pre-January 25 revolution) (2000–2010)	Impact rate (%) for the Second Period (Post-January 25 Revolution) (2011-2016)	Impact rate (%) for the Third Period (Exchange Rate Liberalization) (2017–2023)	Impact rate (%) for the Total Period (2000-2023)
The effect of individual factors:				
1-The effect of the total cultivated area	52.20	-86.15	47.11	113.21
2-The effect of average productivity per feddan	3.09	79.00	-0.16	-36.56
3-The effect of farm price	38.65	40.22	56.69	56.34
The effect of common factors:				
1-The effect of cultivated area and average productivity per feddan	6.65	91.20	36.72	-3.06
2-The effect of average productivity per feddan and farm price	0.02	-22.27	-39.67	-29.90
3- The effect of the total cultivated area and farm price	-1.08	17.08	-29.63	-38.96
4-The effect of farm price, total cultivated area and average productivity per feddan	0.46	-19.08	28.93	38.92
Total	100	100	100	100

Source: Collected and calculated from data in Table (1)
  * Farm prices collected by farmers.

Tripartite Decomposition Analysis for the Third Period (Exchange Rate Liberalization) (2017–2023):

During this period, it was observed that the farm price had the highest impact of the individual factors, with an increase of 56.69% in the production value of the papyrus crop. It can be attributed to the gradual adoption of the Egyptian government's exchange rate liberalization policy, which significantly affected the production value of the papyrus crop. It is dependent on tourism and foreign currency, as well as paper manufacturing, which does not require production requirements that significantly affect its total revenue value. Additionally, the impact of the cultivated area increased the production value by 47.11% due to the country's stability and exchange rate fluctuation, as mentioned earlier resulted in the return of some farmers to crop production, leading to a partial increase in the cultivated area. The primary challenge facing farmers continues to be the marketing of all production. The tourism industry's ineffectiveness has led some to believe that there is a need to activate the role of farmer and producer associations, open the domestic market, and promote papyrus paper. As for the impact of the average productivity per feddan, it resulted in a reduction in production value of approximately 0.16%, which represents the lowest impact of individual factors due to the high impact of both price and cultivated

area. The impact of common factors is as follows: The impact of the cultivated area and the average productivity per feddan increased by 36.72%, representing the highest impact of common factors. Followed by the overall impact of the farm price, the total cultivated area, and the average productivity per feddan by 28.93%. Then there was a decrease in production value for the overall impact of the cultivated area and the farm price of 29.36%. Finally, the impact of the average productivity per feddan and the farm price resulted in a reduction in production value of 39.67%.

First: The process of producing papyrus plants:

Includes the average cost structure of requirements, the average cost structure of agricultural service operations, and the average variable and fixed production cost structure, direct cash (expenditure) and indirect non-cash (imputed).

The average cost structure for producing a feddan of papyrus crop in the field study sample:

The papyrus plant is one kind of perennial plant. It requires a lot of water and chemical fertilizers. It grows in swamps, wetlands, or damp soil. Its cultivation starts with soil preparation, after which a 7–10 cm hole is dug, the seedling is planted, and daily irrigation is applied. The soil must be in direct sunlight and fertilized twice a year with nitrogen fertilizer. Not many agricultural operations are needed for it. Harvesting papyrus stems takes around five to six months, given that mowing occurs

twice a year. The structure of the cost items for producing a feddan of papyrus in the field study sample includes:

Plant on agricultural soil

The average cost structure of production requirements:

Table (3) data shows that 150 seedlings, totaling 2250 pounds per feddan, represent the necessary papyrus production requirements for a feddan in the agricultural season. Additionally, eight shikara of superphosphate fertilizer, costing approximately 1000 pounds, and 46.5% urea fertilizer, about eight shikara, are required. Two shikara obtained from agricultural associations at an average cost of around 480 pounds. The second source, from wholesalers of production requirements, costs about 3000 pounds for six shikara, resulting in a total cost of approximately 3480 pounds for the urea fertilizer of 46.5% from both sources.

Table (3): The average cost structure of production requirements per feddan of the papyrus crop in the field study sample during the agricultural season 2022-2023.

Item	Unit	Source	Number	Price (pound)	Total value
Seedlings	Seedling	Farmers	150	15	2250
Fertilization with superphosphate	shikara	agricultural associations	8	125	1000
Fertilization with Urea 46.5%	shikara	wholesalers of production requirements	2 6	240 500	480 3000

Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

The average cost structure of agricultural service operations:

Table (4) data shows that preparing the land for agriculture includes the plowing process, where a feddan requires three hours with 600 pounds. Next, the planting and seedling process is approximately 450 pounds, which takes three farmers to complete. In addition to fertilization operations, which include fertilization with superphosphate, which costs about 600 pounds per feddan, fertilization with urea, which costs about 300 pounds per feddan, follows the irrigation process, which is done about 15 times and costs 1,050 pounds per feddan. Finally, there was the mowing process, which cost about 2000 pounds per feddan.

Table (4): The average cost structure of agricultural service operations per feddan of the papyrus crop in the field study sample during the agricultural season 2022-2023

Agricultural Operations	Number of practices	Number of workers	Worker's wage	Rent machines	Total value
the plowing process	1	1	0	600	600
the planting and seedling process	1	3	150	0	450
Fertilization with superphosphate	2	2	50	100	600
Fertilization with Urea 46.5%	2	1	50	100	300
the irrigation process	15	1	30	40	1050
the mowing process	2	10	100	0	2000

Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

The structure of the average variable and fixed costs (direct cash (expenditure) and indirect non-cash (imputed)) for the production of papyrus:

Table (5) indicates that the total costs of the feddan of papyrus are divided into variable costs (direct cash (expenditure) and indirect non-cash (imputed)) and fixed costs (direct cash (expenditure) and indirect non-cash (imputed)).

Direct cash variable costs (expenditure):

It includes costs of production requirements and amounted to about 4480 pounds, representing 50.45% of the total variable costs. The costs of agricultural service operations, which include seasonal hired human laborers' wages, amount to about 1,440 pounds, representing 16.22%. And agricultural machinery costs, amounting to about 600 pounds, represent 6.76%. The total direct cash variable costs amounted to about 6520 pounds, representing 73.42% of the total variable costs, during the agricultural season 2022-2023.

Indirect non-cash variable costs (imputed):

Agricultural service operations include seasonal family human laborers' wages, amounting to about 1,760 pounds, representing 19.82%, and agricultural machinery costs, amounting to about 600 pounds, representing 6.76%. The total indirect non-cash variable costs amounted to about 2,360 pounds, representing 26.58% of the total variable costs, which amounted to about 8,880 pounds during the agricultural season 2022-2023.

Table (5): The average cost structure for papyrus production in Al-Qaramous village in the field study sample in Al-Sharkia Governorate during the agricultural season 2022-2023.

Item	Value (pounds)	%[(1)]	%[(2)]
Direct cash variable costs (expenditure)			
Production requirements	4480	50.45	18.34
Agricultural service operations: Seasonal hired human laborers' wages	1440	16.22	5.89
Agricultural service operations: Agricultural machinery costs	600	6.76	2.46
Total direct cash variable costs	6520	73.42	26.69
Indirect non-cash variable costs (imputed)			
Agricultural service operations: Seasonal human family laborers' wages	1760	19.82	7.20
Agricultural service operations: Agricultural machinery costs	600	6.76	2.46
Total indirect non-cash variable costs.	2360	26.58	9.66
Total variable costs	8880	100	36.34
Direct cash fixed costs (expenditure)			
The seasonal cost of seedlings	150	0.96	0.61
The seasonal cost of land preparation operations for agriculture	70	0.45	0.29
The seasonal depreciation cost of the irrigation machine	3333	21.43	13.64
Total direct cash fixed costs	3553	22.84	14.54
Indirect non-cash fixed costs (imputed)			
The average imputed cost rent of feddan	12000	77.16	49.11
Total indirect non-cash fixed costs	12000	77.16	49.11
Total fixed costs	15553	100	63.66
Total costs	24433	-	100

(1) A percentage of the total of each item, (2) A percentage of the total costs
(2) Seasonal cost of seedlings = total value of seedlings / 15 years (the period that the crop remains in the ground)
(3) Seasonal cost of land preparation operations for agriculture = the cost of land preparation operations for agriculture / 15 years
Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

Direct cash fixed costs (expenditure):

The seasonal cost of seedlings is about 150 pounds, representing 0.96%, and the seasonal cost of land preparation operations for agriculture is about 70 pounds, representing 0.45%. The seasonal depreciation cost of the irrigation machine is about 3333 pounds, representing 21.43% of the total direct cash fixed costs, which is about 3553 pounds, representing about 22.84% of the total fixed cost during the agricultural season 2022-2023.

Indirect non-cash fixed costs (imputed):

The average imputed cost rent of feddan is about 12,000 pounds per season, representing 77.16% of the total fixed costs, which amount to

about 15,553 pounds during the agricultural season 2022-2023.

The total costs

Amount to about 24,433 pounds per feddan and include both total variable costs, amounting to about 8,880 pounds per feddan, representing 36.34% (direct cash 25.69% and indirect non-cash 9.66%), and total fixed costs, amounting to about 15,553 pounds per feddan, representing 63.66% (direct cash 14.54% and indirect non-cash 49.11%) during the agricultural season 2022-2023.

Second: the process of manufacturing papyrus papers:

It includes the average cost structure for manufacturing requirements of light and dark-colored papyrus papers, the annual depreciation cost structure for buildings, equipment, and manufacturing tools, the average variable and fixed production costs (direct cash and indirect non-cash), and the average total revenue.

Manufacturing stages

The average cost structure for manufacturing requirements of light and dark-colored papyrus papers in the field study sample:

Table (6) indicates that there are two ways to manufacture papyrus. Both differ in the materials, method of manufacture, and price of papyrus. The workshop manufactures paper by the first method (light) by 75% and paper manufacturing by 25% by the second method (dark) from the total production of papyrus papers in the field study sample.

First method

The first method is the most popular and extensively used to make papyrus, which produces the most popular and widely demanded light-colored paper. To start the paper-making process, papyrus plant stems are cut from the field, tied into bundles, and then transported to the manufacturing workshop. Cutting stems with an electric saw to the necessary lengths for paper manufacturing. Next, the papyrus plant stem's green covering is removed and sliced extremely thinly with a thread similar to that used to make fishing hooks. After that, slices undergo a fermentation process that involves putting them in buckets with water and potassium hydroxide for three hours to remove the sugary substance

(cellulose) and give them flexibility and ease of shaping. The slices undergo a bleaching process that gives them a light color by immersing them in water and chlorine for 30 minutes. After that, slices are washed and stacked next to each other in length and width to the required paper size on a wooden table, and pieces of thin cloth are put between the sheets to absorb water and prevent the sheets from sticking together. By iron press, the paper groups are well-pressed to remove excess water many times, then the papers are separated, put on carton sheets in the sunlight to dry, and finally prepared for marketing.

Second method:

This is an uncommon method in which dry papyrus plant stems are used. The tied slices are soaked for three days in a beam process after cutting stems with an electric saw to the required sizes. Then, slices were put in a tank for cooking using gas for six hours. After that, slices are placed on wooden tables and beaten with a wooden hammer to facilitate shaping and stacking them widthwise and lengthwise. It uses thin plastic to prevent them from sticking together. In this method, plastic is used instead of the cloth used in the first method to prevent the sheets from sticking to the cloth, as the

aim is to retain the sugary substance in the papyrus slices and avoid using any chemicals as in the first method, which is responsible for the dark color of the papyrus sheet. Then, the sheets are pressed with an iron press several times to remove excess water. Finally, the sheets are dried and prepared for marketing.

The average cost structure of requirements for manufacturing: Table (6) shows that the cost items for manufacturing light papyrus paper are the cost of electricity used to operate the electric saw and lighting. The cost of the water used to soak and wash the papyrus slices was about 1,500 pounds for each of them, representing about 25.55% for each of them. The cost of potassium hydroxide was about 1,650 pounds, representing 28.11%. The value of chlorine was about 720 pounds, representing

12.27%. Finally, the cost of the carton sheets was about 500 pounds. It represents 8.52% of the total costs of requirements for manufacturing light papyrus paper, amounting to about 5,870 pounds during the agricultural season 2022-2023.

As for the costs of requirements for manufacturing (dark) papyrus paper, they include the cost of electricity and water, which amounted to about 500 pounds each, representing about 10.87% each, and the cost of gas, which amounted to about 3,600 pounds, representing 78.26%, and there are no chemicals used in this method. Finally, the total costs of the requirements for manufacturing papyrus paper in the second method (dark-colored paper) amounted to about 4,600 pounds during the agricultural season 2022-2023.

Table (6): The average cost structure of requirements for manufacturing light-colored and dark-colored papyrus papers in the field study sample during the agricultural season 2022–2023.

Item	The first method (Light - color paper)		The second method (Dark - color paper)		Total Manufacturing Workshop	
	Value (pounds)	%[1]	Value (pounds)	%[1]	Value (pounds)	%[1]
Electricity	1500	25.55	500	10.87	2000	19.10
Water	1500	25.55	500	10.87	2000	19.10
Gas	-	-	3600	78.26	3600	34.38
Chlorine	720	12.27	-	-	720	6.88
Potassium hydroxide	1650	28.11	-	-	1650	15.76
Carton sheets	500	8.52	-	-	500	4.78
Total costs of requirements	5870	100	4600	100	10470	100

(1)　A percentage of the total costs of manufacturing requirements.
Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

The average depreciation cost Structure of buildings, equipment, and tools for manufacturing light-colored and dark-colored papyrus in the field study sample during the agricultural season 2022–2023:
The first method (light-colored paper):

Table (7) shows that the depreciation cost of tools for manufacturing light-colored papyrus papers, including the average depreciation cost of buildings, amounted to about 1,500 pounds, representing 32.11%, or about a third of the depreciation costs of tools. The cost of the electric saw and the large-sized press was the same. which is 750 pounds each, representing 16.05% each, followed by the cost of depreciation of the tanks amounting to about 700 pounds, representing 14.98%. The depreciation value of the small press is about 500 pounds, representing 10.70%; the depreciation cost of the wooden tables is about 300 pounds, representing 6.42%; and the cost of the cloth is 100 pounds, representing 2.14%. It is used for separating and insulating each sheet of papyrus paper. It facilitates the absorption of excess water from the papyrus paper. The depreciation cost of the buckets amounted to about 60 pounds, representing 1.28%. Finally, the depreciation cost of the cutting thread amounted to 12 pounds, representing about

0.26% of the total depreciation cost of the tools used to manufacture light-colored papyrus paper (the first method), which amounts to 4672 pounds in the field study sample during the agricultural season 2022–2023.

The second method (dark-colored paper):
The depreciation cost for the buildings amounted to about 500 pounds, representing about 28.30%. Followed by the depreciation costs of the electric saw and the large press, amounting to about 250 pounds for each, representing about 14.15% for each. Followed by the depreciation costs of the tanks. It amounted to about 233 pounds, representing 13.19%. The depreciation cost of the small press was about 166 pounds, representing 9.39%. The depreciation cost of the one-burner iron stove amounted to about 133 pounds, representing about 7.53%. The depreciation cost of the wooden table and the plastic was about 100 pounds, representing 5.66% of each. The depreciation cost of the buckets amounted to about 20 pounds, representing 1.13%. Finally, the value of the wooden hammer was 10 pounds, representing 0.57%, and the cost of thread depreciation was about 5 pounds, representing 0.28% of the total tool depreciation, which amounts to about 1,767 pounds for manufacturing dark papyrus paper during 2023. It is

clear from the results that the depreciation costs for the first method are higher than the second because the workshop produces larger quantities of light papyrus, equivalent to three times the amount of dark paper.

The average cost Structure for manufacturing and production of light and dark-colored

papyrus in the field study sample in Al-Sharkia Governorate:

Table (8) shows that the structure of average costs includes variable costs direct (expenditure), indirect (imputed), and fixed costs direct (expenditure), indirect (imputed).

Table (7): The average depreciation costs Structure of buildings, equipment, and tools for manufacturing light and dark papyrus in the field study sample during the agricultural season 2022-2023.

Item	The first method (Light -color paper)		The second method (Dark -color paper)		Total Manufacturing Workshop	
	Value (pounds)	%[1]	Value (pounds)	%[1]	Value (pounds)	%[1]
Buildings	1500	32.11	500	28.30	2000	31.06
Electric saw	750	16.05	250	14.15	1000	15.53
Large Press	750	16.05	250	14.15	1000	15.53
Small Press	500	10.70	166	9.39	666	10.34
Wooden tables	300	6.42	100	5.66	400	6.21
Buckets	60	1.28	20	1.13	80	1.24
Thread	12	0.26	5	0.28	17	0.26
Tanks	700	14.98	233	13.19	933	14.49
Cloth	100	2.14	-	-	100	1.55
Wooden hammer	-	-	10	0.57	10	0.16
Plastic	-	-	100	5.66	100	1.55
One-burner iron stove	-	-	133	7.53	133	2.07
Total depreciation cost of the tools	4672	100	1767	100	6439	100

(1)   A percentage of the total costs of manufacturing requirements.
Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

Table (8): The average cost structure for manufacturing and producing light-colored and dark-colored papyrus papers in the field study sample

Item	The first method (Light -color paper)			The second method (Dark -color paper)			Total Manufacturing Workshop		
	Value (pound)	%[1]	%[2]	Value (pound)	%[1]	%[2]	Value (pound)	%[1]	%[2]
Direct cash variable costs (expenditure)									
production requirements	5870	13.77	7.65	4600	27.30	15.81	10470	17.61	9.89
Transportation	750	1.76	0.98	250	1.48	0.86	1000	1.68	0.94
Seasonal hired human laborers' wages	18000	42.23	23.45	6000	35.61	20.62	24000	40.36	22.67
Total cash direct variable costs (expenditure)	24620	57.77	32.08	10850	64.39	37.28	35470	59.64	33.51
Indirect non-cash variable costs:									
Seasonal human family laborers' wages	18000	42.23	23.45	6000	35.61	20.62	24000	40.36	22.67
Total indirect non-cash variable costs	18000	42.23	23.45	6000	35.61	20.62	24000	40.36	22.67
Total variable costs	42620	100.00	55.53	16850	100.00	57.90	59470	100.00	56.18
Direct cash fixed costs (expenditure)									
Depreciation costs of buildings, machinery and tools	4672	13.69	6.09	1767	14.42	6.07	6439	13.88	6.08
Regular maintenance of machines and equipment	225	0.66	0.29	75	0.61	0.26	300	0.65	0.28
Total cash fixed costs (expenditure)	4897	14.35	6.38	1842	15.03	6.33	6739	14.53	6.37
indirect non-cash fixed costs:									
Imputed cost rent of workshop	4000	11.72	5.21	2000	16.32	6.87	6000	12.94	5.67
Imputed wage for the workshop owner	13687.5	40.10	17.83	4562.5	37.23	15.68	18250	39.35	17.24
Imputed interest on invested capital	11545	33.83	15.04	3849	31.41	13.23	15394	33.19	14.54
Total indirect non-cash fixed costs	29232.5	85.65	38.09	10411.5	84.97	35.77	39644	85.47	37.45
Total fixed costs	34129.5	100.00	44.47	12253.5	100.00	42.10	46383	100.00	43.82
Total costs	76749.5	-	100.00	29103.5	-	100.00	105853	-	100.00

(1)   A percentage of the total of each item, (2) A percentage of the total costs
Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

The total direct variable costs (expenditure) amounted to about 24.620 thousand pounds for light-colored papyrus, about 10.850 thousand pounds for dark-colored papyrus papers, and about 35.470 thousand pounds for the workshop's total production of papyrus papers; these represent about 57.77%, 64.39%, and 59.64% of the total variable costs, respectively, and represent about 32.08%, 37.28%, and 33.51% of the total costs, respectively. The main direct variable costs are seasonal hired laborers' wages, which represent about 42.23%, 35.61%, and 40.36% of the total variable costs, respectively, and 23.45%, 20.62%, and 22.67% of the total costs, respectively. As for the other direct variable costs, they represented together about 15.53%, 28.78%, and 19.29% of the total variable costs, respectively, and about 8.63%, 16.67%, and 10.83% of the total costs, respectively.

The total indirect variable costs include seasonal human family laborers' wages, which amounted to about 18 thousand pounds for the production of light-colored papyrus papers, about 6 thousand pounds for the production of dark-colored papyrus papers, and about 24 thousand pounds for the workshop's total production of papyrus papers, representing about 42.23%, 35.61%, and 40.36% of the total variable costs, respectively, and about 23.45%, 20.62%, and 22.67% of the total costs, respectively. The total variable costs amounted to about 42,620 thousand pounds for the production of light-colored papyrus papers, about 16,850 thousand pounds for the production of dark-colored papyrus papers, and about 59,470 thousand pounds for the workshop's total production of papyrus papers, representing about 55.53%, 57.90%, and 56.18% of the total costs, respectively.

As for the average direct or cash fixed costs, it amounted to about 4.897 thousand pounds for the production of light-colored papyrus, about 1.842 thousand pounds for the production of dark-colored papyrus, and about 6.739 thousand pounds for the workshop's total production of papyrus papers, representing about 14.35%, 15.03%, and 14.53% of the total fixed costs, respectively, and representing about 6.38%, 6.33%, and 6.37% of the total costs, respectively. The main costs of direct fixed costs were the depreciation costs of buildings, machinery, and tools, representing about 13.69%, 14.42%, and 13.88% of the total fixed costs, respectively, and about 6.09%, 6.07%, and 6.08% of the total costs, respectively. The main costs of the total indirect or non-cash fixed costs represented the imputed wage for the workshop owner, which amounted to about 13.687 thousand pounds for the production of light-colored papyrus, about 4.562 thousand pounds for the production of dark-colored papyrus, and about 18.250 thousand pounds for the workshop's total production of papyrus papers, representing about 40.10%, 37.23%, and 39.35% of the total fixed costs, respectively, and about 17.83%, 15.68%, and

17.24% of the total costs, respectively. Followed by imputed interest on invested capital, which amounted to about 11.545 thousand pounds for the production of light-colored papyrus, about 3.849 thousand pounds for the production of dark-colored papyrus, and about 15.394 thousand pounds for the workshop's total production of papyrus papers, representing about 33.83%, 31.41%, and 33.19% of the total fixed costs, respectively, and representing about 15.04%, 13.23%, and 14.54% of the total costs, respectively. The total fixed costs amounted to about 34.129 thousand pounds for the production of light-colored papyrus, about 12.253 thousand pounds for the production of dark-colored papyrus, and about 46.383 thousand pounds for the workshop's total production of papyrus papers, representing about 44.47%, 42.10%, and 43.82% of the total costs, which amounted to about 76.749 thousand pounds for the production of light-colored papyrus, about 29.103 thousand pounds for the production of dark-colored papyrus, and about 105.853 thousand pounds for the production of dark-colored papyrus, respectively.

The average total revenue for the manufacturing and production of light and dark-colored papyrus papers in the field study sample in Al-Sharkia Governorate:

Table (9) shows the average total revenue in pounds for the manufacturing and production of light and dark papyrus papers in Al-Sharkia Governorate, where papyrus papers are produced in different sizes according to demand. The production of papyrus papers of size 40 * 60 centimeters represents about 40% of the total production of papyrus papers, reaching 12 thousand papers of light-colored papyrus and 4,000 dark papyrus papers, with an average price of 11 pounds and 13 pounds, respectively, for a total production of 132,000 and 52,000 pounds, respectively. Followed by papyrus of size 30 * 40 centimeters, and its production represents about 35% of the workshop's total production of papyrus, reaching 10.5 thousand papers of light papyrus and 3.5 thousand papers of dark papyrus at an average price of 6 pounds and 7 pounds, respectively, for a total return of 63 thousand and 24.5 thousand pounds, respectively. Followed by 20 * 30 cm papyrus papers, representing about 18% of the workshop's total production of papyrus, reaching 5.4 thousand light-colored papyrus papers and 1.8 thousand dark papyrus papers, with an average price of 4 pounds and 5 pounds, respectively, for a total return of 21.6 thousand and 9 thousand pounds, respectively.

Then papyrus paper size was 70 cm * 1 meter and produced about 5% of the workshop's total production of papyrus, which amounted to 1.5 thousand papers of light papyrus and 0.500 thousand papers of dark papyrus at an average price of 25 pounds each, for a total return of 37.5 thousand and 12.5 thousand pounds, respectively. As for the

production of papyrus papers of size 80 cm * 1.80 meters, its production represents about 1% of the workshop's total production of papyrus, where it amounted to 0.300 thousand papers of light papyrus and 0.100 thousand papers of dark papyrus at an average price of 100 pounds each, for a total return of 30 thousand and 10 thousand pounds, respectively. Finally, the production of papyrus papers of size one meter * 2 meters represents about 1% of the workshop's total production of papyrus, which amounted to 0.300 thousand papers of papyrus of light color and 0.100 thousand papers of

dark papyrus at an average price of 120 pounds each, for a total return of 36 thousand and 12 thousand pounds, respectively. The sample of the field study showed the interest of papyrus producers in the first type, light-colored papers, because this is the most demanded, and with medium measurements of 40 * 60 centimeters and 30 * 40 centimeters, this type is more suitable and can be marketed in the local market, while papyrus papers of dark color and large sizes are not widespread, and the demand for them is limited and more related to tourism.

(Light -color paper)   **(Dark -color paper)**

Table (9): The average total revenue in pounds for the production and manufacturing of light-colored and dark-colored papyrus papers in Al-Sharkia Governorate.

item	The first method (Light -color paper)			The second method (Dark -color paper)			Total Manufacturing Workshop	
	Quantity (thousand papers)	Price (pound)	Value (thousand pounds)	Quantity (thousand papers)	Price (pound)	Value (thousand pounds)	Quantity (thousand papers)	Value (thousand pounds)
papyrus paper of size 20cm*30cm	5.40	4	21.60	1.80	5	9.00	7.20	30.60
papyrus paper of size 30cm*40cm	10.50	6	63.00	3.50	7	24.50	14.00	87.50
papyrus paper of size 40cm*60cm	12.00	11	132.00	4.00	13	52.00	16.00	184.00
papyrus paper of size 70cm*1m	1.50	25	37.50	0.500	25	12.5	2.00	50.00
papyrus paper of size 80cm*1.80m	0.300	100	30.00	0.100	100	10.00	0.400	40.00
papyrus paper of size 1m*2m	0.300	120	36.00	0.100	120	12.00	0.400	48.00
Total revenue	30.00		320.10	10.00		120.00	40.00	440.10

Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

Economic efficiency indicators in pounds for the production and manufacturing of light-colored and dark-colored papyrus papers in Al-Sharkia Governorate:
The results of Table (10) indicate that the total margin over direct variable costs amounted to about 298,583 thousand pounds for the production of light-colored papyrus papers, 109,503 thousand pounds for the production of dark-colored papers, and 398,110 thousand pounds for the workshop's total

production of papyrus papers. As for the level of paper production, the total margin over direct variable costs amounted to about 9,953 pounds for the light-colored paper, 10,950 pounds for the dark-colored paper, and about 9,953 pounds for the workshop's total production of papyrus paper. It indicates the production efficiency of this activity, its ability to provide new job opportunities, and the possibility of living for agricultural families in these places.

Table (10): Economic efficiency indicators for the production and manufacturing of light-colored and dark-colored papers in the field study sample in Al-Sharkia Governorate

Item	Unit	Value of light -color paper	Value of dark -color paper	value of total Manufacturing Workshop
Total revenue	thousand pounds	320.100	120.000	440.100
Average production quantity	thousand papers	30.000	10.000	40.000
The average selling price of a paper	Pound/paper	10.67	12.00	11.00
The average production cost of a paper	Pound/paper	3.257	3.257	3.257
Total direct variable costs	thousand pounds	31.493	10.498	41.990
Total indirect variable costs	thousand pounds	19.770	6.590	26.360
Total variable costs	thousand pounds	51.263	17.088	68.350
Total direct fixed costs	thousand pounds	7.719	2.573	10.292
Total indirect fixed costs	thousand pounds	38.733	12.911	51.644
Total fixed costs	thousand pounds	46.452	15.484	61.936
Total costs	thousand pounds	97.715	32.572	130.286
Margin over direct variable costs [1]	thousand pounds	298.583	109.503	398.110
Margin over direct variable costs [1]	Pound/paper	9.953	10.950	9.953
Net farm income [2]	thousand pounds	280.889	106.930	387.818
Net farm income [2]	Pound/ paper	9.363	10.693	9.695
Net farm profit [3]	thousand pounds	222.386	87.429	309.814
Net farm profit [3]	Pound/paper	7.413	8.743	7.745
Product margin% [4]	%	69.474	72.857	70.396
Profitability of the Pound Paid [5]	Piaster/ pound	287.458	328.292	297.667
Total revenue/total variable costs		6.244	7.023	6.439
Total revenue/total production costs		3.276	3.684	3.378

(1) Margin over direct variable costs = total revenue - total direct variable costs
(2) Net farm income = total revenue - (total direct variable costs + total direct fixed costs)
(3) Net farm profit = total revenue - total costs
(4) Product Margin % = (Average selling price of papyrus paper - Average production cost of papyrus paper) / Average selling price of papyrus paper
(5) Profitability of the pound paid = total costs / net farm income * 100
Source: It was collected and calculated from the data of tables Nos. (8), (9).

The net farm income amounted to about 280,889 thousand pounds, about 106,930 thousand pounds, and about 387,818 thousand pounds from the workshop's production of papyrus papers. As for the level of paper production, the net farm income amounted to about 9,363 pounds for light-colored paper, about 10,693 pounds for dark-colored paper, and about 9,695 pounds for the workshop's total production of papyrus paper. It indicates the efficiency of the production factors of the workshop's owner, such as the owner's management, human family labor, and the owner's land on which the workshop is built, and the project relies mainly on these factors. The net farm profit from the production of light-colored papyrus papers was about 222.386 thousand pounds; from the production of dark-colored papyrus papers, it was about 87.429 thousand pounds; and about 309.814 thousand pounds for the workshop's total production of papyrus. At the level of paper production, the net farm profit was about 7.413 pounds for light-colored paper, about 8.743 pounds for dark-colored paper, and about 7.745 pounds for the workshop's total production of papyrus. It indicates the possibility of expanding these projects in the long term, where benefits are available to their owners. The product margin of light-colored papyrus papers amounted to

about 69.474%, amounted to about 72.857% of the production of dark-colored papyrus, and amounted to about 70.396% for the workshop's total production of papyrus, which is a satisfactory market incentive for the owners of these projects and encourages the continuation of activity. It is clear that all indicators of estimated efficiency are positive and reflect the availability of benefits, which encourages producers to continue such projects.

The problems facing papyrus farmers and producers in the field study sample:

The results of Table (11) indicate that there are many problems and obstacles facing producers during the production and manufacturing of papyrus papers. The main obstacle is the difficulty of marketing the product because the profit from papyrus papers is correlated to the tourism season, and in a recession or any unstable security situation, the demand for papyrus papers decreases and disappears. The absence of an organization responsible for marketing the product, which represents about 45% of the total producer opinions, Followed by the restricted availability of fertilizer quantities in the agricultural associations and their high prices from wholesalers of production requirements, especially after the first three years of

plant cultivation, as the plant's need for fertilizer increases due to the growth of seedlings and plants, leading the farmer to buy additional quantities of fertilizer from wholesalers of production requirements at high prices, which represents about 25% of the total opinions of producers, and finally The increase in costs of manufacturing requirements and the increase in wages for laborers are needed in the stages of production and manufacturing, as each of them represents about 15% of the total opinions of producers.

Table (11): The producers' problems during the production and manufacturing stages of papyrus papers in the village of Al-Qaramous at Al-Sharkia Governorate during the agricultural season 2022–2023.

The problem	The frequency of the total opinions (%)
1- The difficulty of marketing the product and the absence of an organization responsible for marketing the product	45
2- High costs from wholesalers for production requirements and restricted availability of fertilizer quantities in agricultural associations.	25
3- The increase in manufacturing requirements costs	15
4- The increase in wages for laborers needed in the stages of production and manufacturing	15
Total	100

Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

The producer's proposals for solving problems:

Given the problems presented by the producers and manufacturers of papyrus, several proposals were suggested. Encouraging producers to sell their products both domestically and abroad will make papyrus products more competitive in 40% of the producers' proposals. Table (12) Followed by increasing the quantity of fertilizer required for papyrus plant cultivation by the agricultural associations in Al-Qaramous village, representing 20%, then followed by an increase in the number of workshops for the manufacturing of papyrus papers, which requires skilled laborers from the village's youth to face unemployment in the countryside, and the percentage of each of them reached 15%, and finally supporting the costs associated with producing papyrus and giving the agricultural associations access to requirements like potassium hydroxide, chlorine, and carton sheets by 10%.

Based on the problems and recommendations previously discussed, the study recommends assigning a government agency to manage papyrus marketing operations. Activating the role of tourism through media and advertising, establishing workshops to print cards for events such as weddings and birthdays, and establishing bazaars in each governorate for easy marketing because their prices are lower than other event cards, in addition to printing graduation certificates in various Egyptian universities and Egyptian schools using papyrus so new generations can identify papyrus paper, using the printed papyrus paper in many different industries such as bedspreads, paintings, wooden furniture, and clothes, especially those exported abroad, and in tourist hotels and airports, and presenting it as gifts to tourists. Supporting the costs associated with producing papyrus and giving the agricultural associations access to requirements like potassium hydroxide, chlorine, and carton sheets. Supply the production and manufacturing industries with skilled laborers from the village's youth.

Table (12): The producer's proposals to improve and develop the production and manufacturing of papyrus papers in the village of Al-Qaramous at Al-Sharkia Governorate during the agricultural season 2022-2023.

The proposal	The frequency of the total opinions (%)
1- Encouraging producers to sell their products both domestically and abroad will make papyrus products more competitive.	40
2- Increasing the quantity of fertilizer required for papyrus plant cultivation by the agricultural associations in Al-Qaramous village.	20
3- Increasing number of workshops for the manufacturing of papyrus papers.	15
4- Supplying the production and manufacturing industries with skilled laborers from the village's youth.	15
5- Supporting the costs associated with producing papyrus and giving the agricultural associations access to requirements like potassium hydroxide, chlorine, and carton sheets.	10
Total	100

Source: collected and calculated from field sample data in Al-Sharkia Governorate during the agricultural season 2022-2023.

References:
[1] Alpha Chiang (1972), "Fundamental Methods of Mathematical Economics", Second Edition, McGraw-Hill Book Company, New York, U.S.A. 138-154.
[2] Brown, M. L. (1979). "Farm Budget from Income Analysis to Agricultural Project Analysis", First Edition, The Johns Hopkins University Press, Baltimore and London.
[3] Ronald D. Kay (1981), "Farm Management Planning, Control and Implementation" International Student Education McGraw-Hill international Book Company, Auckland London, Inc., Tokyo Japan.
[4] Mahdy. E. (1997) "Decomposition of policy Reforms Impacts on Crop Choices of

Productivity and Production in Egypt". The Egyptian Journal of Agricultural Economics. Vol. 7. No.1. March.

[5] Fatma Al-Waseify, Asmaa Taha (2020), "Decomposition of the Impact of Agricultural Policies on the Values of Cereal Crops in Egypt" Journal of Agricultural Economics & Rural Development; Suez Canal University, Volume 6 (1), 25-38.

[6] The Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Summer Agricultural Statistics and the Nile Crops Bulletin, multiple editions.

[7] The Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Summer Agricultural Statistics and the Nile Crops Bulletin, multiple editions.

[8] Directorate of Agriculture in Al-Sharkia Governorate, Department of Statistics, Official Records, Unpublished Data, 2023.

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