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Analysis of the Economic and Social Impacts of a Silk Production Project in Egypt

Eliw, M.[1*] and Sharaa, D. E. I.[2]

1- Department of Agricultural Economics Faculty of Agriculture, Beni-suef University, Egypt.

2- Department of Agricultural Economics, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt

Abstract

The current research aims to analyze the economic and social impacts of the silk production project in Egypt through study the current production status of silk in Egypt during the period (2005-2022) and estimate the quantity of silk imports during the same period. Besides analyze the economic and social feasibility of the silk production project in Egypt to identify the main problems and constraints facing silk breeders in Egypt. The main results are shown that the quantity of silk threads produced during the study period (2005-2022) ranged between a minimum of about 245 Kg in 2014 and a maximum of about 2520 Kg in 2005, with an annual average of about 1005.44 Kg. The total return value for the first year of rearing is approximately 145.000 Egyptian pounds, increasing to about 226.000 Egyptian pounds in the second year of rearing, starting from the third year of the project's operation. These returns continue until the end of the project's lifespan and may slightly vary based on prevailing market prices. The results showed that the concerning the problems faced by the beneficiaries of the silk production project from silkworms the most significant problem is marketing and distribution, with a relative importance of approximately 20% of the total problems. In the second place, there is a problem with the lack of training in modern breeding methods, accounting for about 17.78%.

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*Corresponding authors: **Moataz Eliw**

E-mail: moatazeliw@gmail.com

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مجلة العلوم الزراعية والتنمية المستدامة

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تحليل الآثار الاقتصادية والاجتماعية لمشروع إنتاج الحرير في مصر

معتز عليو مصطفى أحمد[1]*، ضياء الحق إبراهيم شرع[2]

1- قسم الاقتصاد الزراعى- كلية الزراعة – جامعة بنى سويف – مصر
2- قسم الاقتصاد الزراعى- كلية الزراعة بالقاهرة- جامعة الأزهر - مصر

الملخص العربى:

استهدف البحث الحالي تحليل الآثار الاقتصادية والاجتماعية لمشروع إنتاج الحرير في مصر من خلال دراسة الوضع الحالي لإنتاج الحرير خلال الفترة (2005–2022) وتقدير كمية واردات الحرير خلال نفس الفترة. بالإضافة إلى تحليل الجدوى الاقتصادية والاجتماعية لمشروع إنتاج الحرير في مصر للتعرف على أهم المشاكل والمعوقات التي تواجه مربي الحرير في مصر. وأظهرت النتائج أن كمية خيوط الحرير المنتجة خلال فترة الدراسة (2005–2022) تراوحت بين حد أدنى بلغ حوالي 245 كجم عام 2014 وحد أقصى بلغ حوالي 2520 كجم عام 2005، وبمتوسط سنوي بلغ حوالي 1005.44 كجم. وتبلغ قيمة العائد الإجمالي للسنة الأولى للتربية حوالي 145.000 ألف جنيه مصري، وترتفع إلى حوالي 226.000 ألف جنيه مصري في السنة الثانية للتربية، بدءاً من السنة الثالثة لتشغيل المشروع، وتستمر هذه العوائد حتى نهاية عمر المشروع وقد تختلف قليلاً بناءً على أسعار السوق السائدة، كما أظهرت النتائج أن أهم المشاكل التي يواجهها المستفيدون من مشروع إنتاج الحرير من دودة القز هي مشكلة التسويق والتوزيع، حيث تشكل أهميتها النسبية حوالي 20% من إجمالي المشاكل، بينما جاءت مشكلة قلة التدريب على طرق التربية الحديثة فى المرتبة الثانية حيث بلغت نسبتها حوالي 17.78%.

بيانات البحث:

*الباحث المسئول: معتز عليو مصطفى أحمد
moatazeliw@gmail.com
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INTRODUCTION:

The agricultural sector is considered a driving force for developing other sectors through vertical expansion, as it contributes to achieving comprehensive economic and social development of the country **(Reddy et al., 2022).** This can be achieved through an agricultural development plan that includes programs to increase the production and productivity of goods that are imported from abroad. This would reduce pressure on the trade deficit, which reached about $37 billion during 2023, especially after the recent exchange rate declines **(Lakshmanan et al., 2008)**.

Silk production is of special interest to developing countries as it is one of the most important agro-industrial activities because it creates high added value in addition to requiring small capital to operate, a short cycle, and employing family labor **(Hosali and Murthy, 2015).** This helps reduce unemployment rates, which is one of the main challenges in rural areas. It is also an agricultural activity suitable to raise the living standards of rural people **(Ahmad et al., 2006)**. Therefore, more attention should be given to silk production in Egypt not only for these aforementioned reasons, but also because the locally produced silk quantity does not meet domestic consumption requirements even though the Egyptian climatic conditions are very suitable for domestic silk production **(Anonymous, 2002)**. Additionally, it is a low environmental impact activity which enhances the opportunities for sustainable development of the country **(CAPMS, 2022).**

Egypt is considered one of the countries capable of filling the gap resulting from China's withdrawal, due to its moderate weather conditions and low labor costs. It is the first silk producing country in the Arab world. The silk industry is important for absorbing intensive labor, and silk is an export product capable of competing globally, bringing hard currency, and also reducing the import bill for the silk required for manufacturing. Egypt produces about 1.5 tons of natural silk annually while needing about 300 tons annually that are compensated from abroad. Meanwhile, the world produces an average of 120 thousand tons annually for the period from (2017-2022). China produces about 67% of this quantity followed by India with about 29%, then the rest of the world.

Recently, China has refrained from exporting and manufacturing silk due to the rise in the standard of living of the Chinese individual and the desire to add value. The size of the spun silk market is estimated to be around $39.4 billion in 2023, and it is expected to reach about $45.7 billion by 2028 with an average annual growth rate of around 30% (**CAPMS, 2022**).

RESEARCH PROBLEM:

Egypt's production of natural silk has declined recently, with production quantity reaching around 1.5 tons, while we need 300 tons annually, compensated by imports; after Egypt was a pioneer in this field, as it was famous for clothing, carpets and fabrics manufacturing. Nevertheless, there remain more undiscovered opportunities. Egypt’s rich technical production capabilities, the continuous domestic and foreign demand for silk products, the eco-friendly nature of production, and high family participation motivate the commercial exploitation of this craft.

IMPORTANCE OF THE RESEARCH:

The silk production from silkworm project is

considered one of the most important small projects, as it contributes to achieving several objectives including: providing job opportunities that absorb the workforce, especially rural women; increasing the income of farmers; adding value; achieving a source of foreign currency income by exporting manufactured silk products, which provides hard currency; it is considered one of the projects that contribute to achieving sustainable development and preserving the environment. This project's objectives are also in line with the Egyptian state's sustainable development goals in creating integrated urban communities. It also enhances the state's future vision to revive the historical Silk Road trade route between Egypt and China.

RESEARCH OBJECTIVES:

The main objective of the current research is to analyze the economic and social impacts of the silk production project in Egypt through the following sub-objectives:

1. Study the current production status of silk in Egypt during the period (2005-2023).
2. Estimate the quantity of silk imports during the same period.
3. Analyze the economic feasibility of the silk production project in Egypt.
4. Analyze the social feasibility of the silk production project in Egypt.
5. Identify the main problems and constraints facing silk breeders in Egypt.
6. Develop recommendations that would benefit decision makers and policy makers in Egypt.

MATERIAL AND METHODS:

This research relied on descriptive and quantitative statistical analysis methods to achieve its objectives, consisting of data description, calculating averages, percentages, net profit, capital recovery period, and the ratio of the present value of returns to the present value of costs, in addition to estimating simple linear regression equations.

The research relied on two sources of data: published and unpublished secondary data issued by official and governmental entities including the Central Agency for Public Mobilization and Statistics, publications of the Economic Affairs Sector at the Ministry of Agriculture, as well as scientific research and studies related to the topic of this research. The research also relied on primary data by designing a simple random sample questionnaire representing 14% of the research population, which includes 355 breeders, with the research sample size being 50 breeders. This questionnaire included the economic and social variables related to the research sample from different governorates in Egypt.

Project evaluation serves the pivotal role of determining whether a project is worthy of acceptance or rejection based on specific criteria. Among these criteria, the paramount factors include Net Present Value (NPV), Benefit-to-Cost Ratio (BCR), Internal Rate of Return (IRR), and Payback Period (PBP). The subsequent elucidation will delineate the classification of cash inflows and outflows arising from the project:

Net Present Value (NPV) stands as a crucial financial metric utilized for gauging the viability of a project or investment. The computation of NPV involves estimating the present value of all anticipated cash inflows and outflows associated with the project over a designated timeframe, employing a predetermined discount rate. This method facilitates a comprehensive assessment of

the project's financial feasibility by considering the time value of money and aiding decision-makers in their evaluation process.

The basic equation for calculating NPV:

$$NPV = \Sigma\ (CFt / (1 + r)^t)$$

Where:

- NPV is the Net Present Value.
- CFt is the cash flow in period t.
- r is the discount rate (required rate of return).
- t is the time period.

A positive NPV signifies the profitability of an investment or project, denoting that the present value of cash inflows surpasses the initial investment cost. Conversely, a negative NPV suggests that the investment is not financially viable.

Calculation of NPV entails assessing each cash flow, whether positive or negative, across multiple time periods. The summation of these individual present values yields the overall net value of the project. This comprehensive approach allows decision-makers to gain insights into the financial attractiveness of the investment.

For well-informed decision-making regarding a specific investment, a crucial step involves comparing the Net Present Value of cash flows associated with the project against the capital cost or the cost of alternative opportunities. This comparative analysis aids in evaluating the project's financial merit and assists in determining whether it represents a lucrative venture or if alternative options might offer a more favorable return on investment.

The Benefit-to-Cost Ratio (BIC)

BIR is indeed a key metric utilized for evaluating the feasibility of projects or investments. It involves comparing the present value of anticipated returns generated by a project to the present value of the costs invested in that project. The Benefit-to-Cost Ratio is calculated by dividing the present value of benefits by the present value of costs, providing decision-makers with a ratio that helps assess the economic viability and desirability of the investment. A BIR greater than 1 indicates that the benefits outweigh the costs, suggesting a potentially favorable investment. Conversely, a BIR less than 1 may indicate a less attractive proposition.

The basic equation to calculate BIC is:

$$BIC = \frac{\text{Cash Returns}}{\text{Cash Costs}}$$

The Internal Rate of Return (IRR):

Serves as a crucial financial metric employed to assess the potential profitability of an investment or project. It delineates the annualized rate of return at which the net present value (NPV) of future cash flows from the investment becomes zero. Essentially, IRR signifies the rate at which the investment achieves a break-even point in terms of cash flows.

To compute the IRR, the following steps are typically undertaken:

- Identify the cash flows: Enumerate all anticipated future cash flows associated with the investment, encompassing both positive (incoming) and negative (outgoing) cash flows.
- Set up the equation: The IRR is the rate 'r' at which the sum of the present values of positive cash flows equals the sum of the present values of negative cash flows. Mathematically, this involves solving for 'r' in the equation:

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots + \frac{CF_n}{(1+IRR)^n}$$

Or

$$0 = NPV = \sum_{n=0}^{N} \frac{CF_n}{(1+IRR)^n}$$

Where:
CF_0 = Initial Investment / Outlay
$CF_1, CF_2, CF_3 \ldots CF_n$ = Cash flows
n = Each Period
N = Holding Period
NPV = Net Present Value
IRR = Internal Rate of Return

The IRR provides valuable insights into the project's financial attractiveness, with a higher IRR generally indicating a more lucrative investment opportunity. Decision-makers often compare the IRR with a predetermined hurdle rate or cost of capital to make informed investment decisions.

The Payback Period (PBP)

The Payback Period is a straightforward financial metric utilized to assess the duration required for an investment to generate sufficient cash flows to recover the initial investment cost. Essentially, it provides insight into the timeframe within which the project "pays back" the capital invested in it.

To compute the Payback Period, the following steps are typically followed:

1- Identify the cash flows: Enumerate all anticipated future cash flows associated with the investment, encompassing both positive (incoming) and negative (outgoing) cash flows.

2- Calculate cumulative cash flows: Begin by summing up the cash flows, starting from the initial period, until the cumulative cash flow equals or surpasses the initial investment cost.

3- Determine the Payback Period: The Payback Period is the time taken for the cumulative cash flows to meet or exceed the initial investment. This duration is commonly expressed in terms of years, months, or other relevant time units.

The Payback Period metric is particularly useful for investors seeking a quick assessment of how soon they can recoup their initial investment. However, it should be used alongside other metrics, such as Net Present Value (NPV) and Internal Rate of Return (IRR), for a more comprehensive evaluation of an investment's financial viability.

RESULTS AND DISCUSSION:

(1) The current status of the amount of production and imports of natural silk in Egypt during the period (2005-2022):

(A) Quantity and Value of Egg Cartons: From the data presented in Table (1), it is evident that the quantity of egg cartons produced during the study period (2005-2022) ranged between a minimum of around 84 cartons in 2014 and a maximum of around 900 cartons in 2000, with an annual average of about 345.28 cartons. By estimating the general time trend equation, it is shown from equation (1) in Table (2) that the quantity of egg carton production followed a decreasing general trend that is not statistically significant, indicating the relative stability of the studied phenomenon around its annual average. By studying the same data, it appears that the value of egg carton production during the study period ranged between a minimum of about 8.400 pounds in 2015 and a maximum of about 150.150 thousand pounds in 2022, with an average of about 49.707 thousand pounds. By estimating the general time trend equation, it is shown from equation (2) in Table (2) that the value of egg carton production followed an increasing general trend that is statistically significant, estimated at about 5832.15 pounds from the annual average,

with an annual increase rate of about 11.73%. The coefficient of determination (R^2) indicates that about 47% of the changes occurring in the value of egg production are due to the variables reflected by the time variable, while about 53% of these changes are due to other unmeasured variables in the model.

(B) Quantity and Value of Silk Cocoons: From the data presented in Table (1), it is evident that the quantity of silk cocoons produced during the study period (2005-2022) ranged between a minimum of about 729 Kg in 2015 and a maximum of about 7.875 Kg in 2005, with an annual average of about 3078.83 Kg. By estimating the general time trend equation, it is shown from equation (3) in Table (2) that the quantity of silk cocoon production followed a decreasing general trend that is not statistically significant, indicating the relative stability of the studied phenomenon around its annual average.

By studying the same data, it appears that the value of silk cocoon production during the study period ranged between a minimum of about 65.610 thousand pounds in 2015 and a maximum of about 545.160 thousand pounds in 2022, with an average of about 255,859 thousand pounds. By estimating the general time trend equation, it is shown from equation (4) in Table (2) that the value of silk cocoon production followed an increasing general trend that is statistically significant at a 0.05 significance level, estimated at about 12,103 thousand pounds from the annual average, with an annual increase rate of about 4.73%. The coefficient of determination (R2) indicates that about 24% of the changes occurring in the value of silk cocoon production are due to the variables reflected by the time variable, while about 76% of these changes are due to other unmeasured variables in the model.

(C) Quantity and Value of Silk Threads: By studying the data presented in Table (1), it appears that the quantity of silk threads produced during the study period (2005-2022) ranged between a minimum of about 245 Kg in 2014 and a maximum of about 2520 Kg in 2005, with an annual average of about 1005.44 Kg. By estimating the general time trend equation, it is shown from equation (5) in Table (2) that the quantity of silk thread production followed a decreasing general trend that is not statistically significant, indicating the relative stability of the studied phenomenon around its annual average.

By studying the same data, it appears that the value of silk thread production during the study period ranged between a minimum of about 98 thousand pounds in 2014 and a maximum of about 1,558 thousand pounds in 2022, with an average of about 558,630 thousand pounds. By estimating the general time trend equation, it is shown from equation (6) in Table (2) that the value of silk thread production followed an increasing general trend that is statistically significant at a 0.01 significance level, estimated at about 69.586 thousand pounds from the annual average, with an annual increase rate of about 12.46%. The coefficient of determination (R^2) indicates that about 58% of the changes occurring in the value of silk thread production are due to the variables reflected by the time variable, while about 42% of these changes are due to other unmeasured variables in the model.

Table (1): Quantity and value of local production of natural silk in Egypt during the period (2005-2022)

Year	Number of egg cartons			Natural silk cocoons			Natural silk threads			Total Imports	
	Quantity	Box price	Value (EGP)	Quantity	Box price	Value (EGP)	Quantity	price	Value (EGP)	Quantity	Value (EGP)
2005	900	60	32000	7875	40	315000	2520	140	352800	326783	4528
2006	500	60	54000	4375	48	210000	1400	160	224000	59608	2438
2007	500	70	30000	4375	50	218750	1400	200	280000	111517	2297
2008	300	50	35000	4375	50	218750	1000	160	160000	75516	4185
2009	200	50	15000	3000	55	165000	721	170	122570	138301	6815
2010	195	45	10000	2249	55	123695	624	200	124800	126553	2257
2011	195	45	8775	1950	80	156000	595	350	208250	17946	1549
2012	200	65	8775	1715	90	154350	600	300	180000	4931	1247
2013	200	70	13000	2100	120	252000	667	460	306820	1117	384
2014	84	100	14000	2000	80	160000	245	400	98000	7062	1429
2015	277	150	8400	729	90	65610	808	600	484800	3550	1209
2016	345	180	41550	2424	100	242400	1006	800	804800	5661	1034
2017	400	250	62100	3019	120	362280	1200	800	960000	3674	3469
2018	450	300	100000	3600	150	540000	1350	1000	1350000	45136	2731
2019	411	250	135000	3312	100	331200	1295	1100	1424500	44914	2620
2020	371	300	102750	3024	120	362880	895	1000	895000	44692	2509
2021	232	320	74240	1403	130	182390	474	1100	521400	45320	3257
2022	455	330	150150	3894	140	545160	1298	1200	1557600	46136	3889
Average	**345.28**	**149.72**	**49707.78**	**3078.83**	**89.89**	**255859.2**	**1005.44**	**563.33**	**558630**	**61578.72**	**2658.17**
Max	**900**	**330**	**150150**	**7875**	**150**	**545160**	**2520**	**1200**	**1557600**	**326783**	**6815**
Min	**84**	**45**	**8400**	**729**	**40**	**65610**	**245**	**140**	**98000**	**1117**	**384**

Source: Central Agency for Public Mobilization and Statistics, Annual Bulletin of Livestock Statistics, various issues

Table (2): Time trend equations for the quantity and value of local production of natural silk in Egypt during the period (2005-2022)

Eq. No	Dependent variable	Model Equations	average	A. of change	A. Chang rate%	$\bar{R}^2$	F
1	Quantity of eggs (Box)	$\hat{Y}t = 418.72 - 7.73x$ $(4.58)^{**}$ (-0.915)	345.28	-	-	0.05	0.836^{ns}
2	Value of eggs (EGP)	$\hat{Y}t = -5679.61 + 5832.15x$ (-0.341) $(3.78)^{**}$	49707.8	5832.15	11.73	0.47	14.29^{**}
3	Quantity of silk cocoons (Kg)	$\hat{Y}t = 4367.18 - 135.62x$ $(6.02)^{**}$ (-2.02)	3078.83	-	-	0.20	4.09^{ns}
4	Value of silk cocoons (EGP)	$\hat{Y}t = 140877.94 + 12103.29x$ $(2.40)^{*}$ (2.24)	255859.2	12103.29	4.73	0.24	4.99^{*}
5	Quantity of silk threads (Kg)	$\hat{Y}t = 1260.68 - 26.867x$ $(5.023)^{**}$ (-1.16)	1005.44	-	-	0.08	1.34^{ns}
6	Value of silk threads (EGP)	$\hat{Y}t = -102435.7 + 69585.9x$ (-0.643) $(4.73)^{**}$	558630	69585.9	12.46	0.58	22.34^{**}
7	Quantity of total imports (Kg)	$\hat{Y}t = 139509.4 - 8203.23x$ $(4.19)^{**}$ $(-2.66)^{*}$	61578.72	–8203.23	-13.32	0.31	7.10^{**}
8	Value of total imports (EGP)	$\hat{Y}t = 3079.27 - 44.33x$ $(3.98)^{**}$ (-0.619)	2658.17	-	-	0.02	0.384^{ns}

Source: Table 1 ** Significant at the level 0.01 * Significant at the level 0.05 ns= Not significant

(D) Quantity and Value of Natural Silk Imports: By studying the data presented in Table (1), it appears that the quantity of silk imports during the study period (2005-2022) ranged between a minimum of about 1117 Kg in 2013 and a maximum of about 326.783 Kg in 2005, with an annual average of about 61.79 Kg. By estimating the general time trend equation, it is shown from equation (7) in Table (2) that the quantity of silk imports followed a decreasing general trend that is statistically significant, estimated at about 8203 Kg from the annual average, with an annual decrease rate of about 13.32%. The coefficient of determination (R2) indicates that about 31% of the changes occurring in the quantity of silk imports are due to the variables reflected by the time variable, while about 69% of these changes are due to other unmeasured variables in the model.

By studying the same data, it appears that the value of natural silk imports during the same study period ranged between a minimum of about 384 thousand pounds in 2013 and a maximum of about 6.815 thousand pounds in 2009, with an average of about 2658.17 thousand pounds. By estimating the general time trend equation, it is shown from equation (8) in Table (2) that the value of natural silk imports followed a decreasing general trend that is not statistically significant, indicating the relative stability of the studied phenomenon around its annual average.

(2) Economic Study:

The ongoing operations of the project are sustained by a continual numerical value throughout its lifespan. This figure encompasses the permanent agricultural workforce, temporary labor, and essential production supplies among these supplies, mulberry leaves hold a critical role. Interestingly, these leaves are unique in their treatment, being simultaneously considered as both a product and a component of production supplies. Notably, in the project's production calculations, the intrinsic importance of mulberry leaves is acknowledged, yet they have not been explicitly categorized within the operational costs. This distinctive dual role underscores their

significance in the project's production dynamics, shaping both the product itself and the resources essential for its cultivation.

Cash Outflows: These are the costs in all their forms, representing the burdens that the project bears. They are divided into investment costs and operational costs of the project.

Investment Costs: To study the investment costs during the project establishment period, it is assumed that the project has a lifespan of 20 years, starting its operations during the first summer season. It begins by selecting and preparing the land for cultivation, leveling it, planning on a 2-meter distance, laying irrigation pipes, and preparing the soil for planting. Then, during the following winter season, mulberry seedlings are planted, which will produce the leaves used for silkworm rearing.

Cash inflows: Cash inflows include the project's revenues, representing the value of both primary and secondary production. These revenues denote the positive aspect or benefits that the project will obtain throughout its productive lifespan. It is anticipated that these cash inflows will commence in the third year of the project, starting with the rearing of 25 egg boxes.

Each box is expected to yield an average of 9 trays of silkworms. This results in a total of 225 trays of silkworms in the first cycle, producing 350-400 grams per tray. Therefore, the output is approximately 84.3 Kg of raw silk threads in the first year, which increases to about 135 Kg in the subsequent year, as illustrated in Table (4). This raw material could potentially be used for hand-woven carpets, with a market price of around 20.000 Egyptian pounds per meter. However, this production style requires highly skilled labor that is difficult to find and comes with elevated costs.

As a result, this study is limited to marketing raw silk threads (silkworms) as a product. There are also secondary products in the project, including defective silkworms, larval waste, and the value of mulberry fruit. The study estimates their total value at around 10.000 Egyptian pounds per cycle. Thus, the total return value for the first year of rearing is approximately 145.000 Egyptian pounds, increasing to about 226.000 Egyptian pounds in the second year of rearing, starting from the third year of the project's operation. These returns continue until the end of the project's lifespan and may slightly vary based on prevailing market prices.

Business Profitability Criteria for the Project:

This section shows the analysis of Commercial profitability from the investor's perspective, there are several criteria used for evaluation and calculating business profitability, as subsequent:

Net Present Value (NPV) of the Project: When calculating the Net Present Value, future cash flows are discounted using a specific discount rate to obtain their present value at a certain future year. The NPV of returns and expected costs has been calculated based on a discount rate of 9%, which is equivalent to the prevailing market interest rate (opportunity cost during the study preparing period). The NPV of the project has been calculated by subtracting the present value of costs (885.2 thousand Egyptian pounds) from the present value of returns (1599.4 thousand Egyptian pounds). The NPV of the project amounted to approximately 714.2 thousand Egyptian pounds. This positive and substantial NPV signifies that the project is capable of generating substantial profits, as shown in Table (5). This indicates that the NPV is positive and significant, implying that the project is capable of generating substantial profits.

Table (3): Costs and outflows of the project to produce natural silk from an area of one acre during the first five years of the life of the project

Investment costs				Operational costs					
First year		Second year		Third year		Fourth year		Fifth year	
Items	**Value EGP**	**Items**	**Value EGP**	**Items**	**Value EGP**	**Items**	**Value EGP**	**Items**	**Value EGP**
Mulberry seedlings/7000 seedlings/feddan	48000	Breeding room 300 M^2	30000	Irrigation	2000	Irrigation	2000	Irrigation	2000
Land processing	5000	Irrigation	2000	Electricity	3000	Electricity	3000	Electricity	3000
Organic and chemical fertilizers	8000	Organic and chemical fertilizers	8000	Organic and chemical fertilizers	8000	Organic and chemical fertilizers	8000	Organic and chemical fertilizers	8000
Irrigation network	20000	Permanent Labor	30000	Permanent Labor	30000	Permanent Labor	30000	Permanent Labor	30000
Land rent	10000	Net for cleaning	2500	Temporary Labor	4000	Temporary Labor	4000	Temporary Labor	4000
Permanent Labor	30000	Nesting net	2500	Land rent	10000	Land rent	10000	Land rent	10000
		Leaf shredding machine	2000	Disinfectants	2500	disinfectants	2500	disinfectants	2500
		Land rent	10000	Expenses	4000	Expenses	4000	Expenses	4000
		Silk cupboard	30000	Egg box 25	17500	40 Egg box	28000	40 Egg box	28000
		Utensils cooking cocoons	5000						
		Breeding stands and trays	8000						
Total	121000		130000		81000		91500		91500

Source: Collected and calculated at market prices, 2023.

Internal Rate of Return (IRR): This criterion is defined as the discount rate that makes the present value of net cash flows equal to zero. It's important to note that the IRR is considered one of the most significant project evaluation criteria, widely used by institutions. We can accept the project if its Internal Rate of Return is greater than the opportunity cost (market interest rate).

The Internal Rate of Return for this project was found to be 38%, which mean that the project is feasible, because of the Internal Rate of Return, greater than the market interest rate.

Benefit-to-Cost Ratio (BCR): This criterion is a relative measure opposite to the Net Present Value (NPV) of the project. It is calculated by dividing the total Present Benefits Value by the total Present costs Value. If this ratio is greater than one, it indicates that the project's returns can cover its costs, and the project acceptable. If the ratio less than one, the project is rejected. If the ratio equals one, it means that the project's returns are equal to its costs.

The results in Table (5) illustrates that the cash flows of returns and costs along with their present values, it's evident that the Benefit-to-Cost Ratio is approximately 1.8 This positive value and greater than one, it is confirms that the project is profitable and capable of recovering the initial invested capital.

Payback Period (PBP): The payback period is the number of years that required for the project's net cash flows, to covers the investment costs. This criterion can be used as an auxiliary factor for comparing projects. It reached 6.2 years.

Table (4): Costs of Cash Inflows for the Natural Silk Production Project from One feddan during the First Three Years after Commencing Operation

Items	Third year		Fourth year	
	Quantity	Value (L.E)	Quantity	Value (L.E)
Pupae quantity	225	135000	360	216000
Secondary Production				
Defective cocoons	-	2000	-	2000
Berries	-	4000	-	4000
Larval excrement	-	4000	-	4000
Total	-	145000	-	226000

Source: Collected and calculated at market prices, 2023.

Sensitivity Analysis for the Project:

Sensitivity analysis involves studying potential negative changes in both output and input prices to ensure the project remains secure and profitable. It ensures that the project can recover the invested capital and maintain a certain profit margin. Therefore, a sensitivity analysis was conducted for the project under various scenarios:

Case of 15% Cost Increase: It's evident that the Net Present Value decreases to around 651.396 thousand Egyptian pounds and the Benefit-to-Cost Ratio drops to about 1.35 The Internal Rate of Return also decreases to approximately 22% compared to the studied scenario. However, the Payback Period increases to about 8.9 years. Despite these changes, the project remains profitable, secure, and capable of sustaining profits.

Case of 15% Revenue Decrease: The Net Present Value decreases to approximately 517.300 thousand Egyptian pounds and the Benefit-to-Cost Ratio decreases to about 1.32 The Internal Rate of

Return also decreases to around 20% compared to the studied scenario. The Payback Period increases to about 9.8 years. Despite these variations, the project remains profitable, secure, and able to generate profits over time.

Table (5): The cash flows of costs and returns of the current value with discount rate 9% for the silk breeding and production project (one feddan)

Years	Revenues	Costs	Discount rate	Present value of revenue	Present value of costs	Net flow	Present value of Net flow	Cumulative net Present value
1		121000	0.917		110957	-121000	-121000	-121000
2		130000	0.842		109460	-130000	-130000	-251000
3	145000	81000	0.772	111940	62532	64000	49408	-201592
4	226000	91500	0.708	160008	64782	134500	95226	-106366
5	226000	91500	0.65	146900	59475	134500	87425	-18941
6	226000	91500	0.596	134696	54534	134500	80162	61221
7	226000	91500	0.547	123622	50051	134500	73572	134793
8	226000	91500	0.502	113452	45933	134500	67519	202312
9	226000	91500	0.46	103960	42090	134500	61870	264182
10	226000	91500	0.422	95372	38613	134500	56759	320941
11	226000	91500	0.388	87688	35502	134500	52186	373127
12	226000	91500	0.356	80456	32574	134500	47882	421009
13	226000	91500	0.326	73676	29829	134500	43847	464856
14	226000	91500	0.299	67574	27359	134500	40216	505071
15	226000	91500	0.275	62150	25163	134500	36988	542059
16	226000	91500	0.252	56952	23058	134500	33894	575953
17	226000	91500	0.231	52206	21137	134500	31070	607022
18	226000	91500	0.212	47912	19398	134500	28514	635536
19	226000	91500	0.194	43844	17751	134500	26093	661629
20	226000	91500	0.164	37064	15006	134500	22058	683687
Total				**1599472**	**885202**		**683687**	

Source: Collected and calculated at market prices, 2023.

(3) Social Study:

Research variables and measurement methods as follows:

In this study, several independent variables were considered, each providing valuable insights into different aspects of the participants' characteristics and experiences. These independent variables include:

Independent Variables:

(1) Age:

Measurement: Age was quantified in Gregorian years, representing the time elapsed since the participant's birth up to the date of data collection. It was rounded to the nearest Gregorian year.

(2) Years of Education:

Measurement: The variable reflects the number of years of formal academic education completed by the participant.

Representation: Expressed using symbols (3, 2, 1) to denote different levels of education: (3) below average, (2) average, and (1) university.

(3) Family Size:

Measurement: The size of the family unit was determined by the count of individuals residing in the same household.

(4) Agricultural Holdings Size:

Measurement: Assessed by the number of plots of land owned by the participant.

Representation: The symbols (2, 1) were used to indicate ownership and leasing, respectively,

serving as indicators of the size of agricultural holdings.

(5) Exposure to Communication Channels:

Measurement: Quantified by assessing participants' exposure to various sources of information, including newspapers, magazines, rural television programs, rural radio programs, Egypt's agricultural channel, and the internet.

Response Choices: Participants provided responses indicating the frequency of exposure (always, sometimes, rarely), assigned numerical values (3, 2, 1), respectively.

Scoring: The scores were summed, ranging from 5 to 20, representing the degree of exposure to information sources.

Categorization: Participants were grouped into three levels based on their exposure scores: low exposure (less than 9 points), moderate exposure (9-14 points), and high exposure (15-20 points).

(6) Openness to the Outside World:

Measurement: This variable gauges participants' engagement in activities that signify openness to the external environment, including travel to the town center, province, other provinces, and abroad.

Response Choices: Participants provided responses (always, sometimes, rarely), assigned numerical values (3, 2, 1) respectively.

Scoring: Scores were summed, ranging from 5 to 15, reflecting the degree of openness to the outside world.

(7) Reference Sources:

Measurement: Participants were queried about the sources or individuals they turn to when facing project-related problems.

Response Choices: Participants rated their reliance on different sources (personal experience, family and neighbors, project colleagues, agricultural advisor, veterinary unit, university professors and research centers, training courses) using values (3, 2, 1).

Scoring: Scores were summed, ranging from 3 to 21, indicating the level of satisfaction with public services.

Categorization: Participants were categorized based on scores into three levels: low-level sources (less than 5 points), moderate-level sources (6-13 points), and high-level sources (14-21 points).

(8) Participation in Organizations:

Measurement: Participants indicated their membership in official village organizations, including agricultural cooperative associations, local councils, and political parties.

Response Choices: Ratings (3, 2, 1) were assigned for membership choices.

Scoring: Scores ranged from 5 to 15, reflecting the extent of participation in organizations.

(9) Household Amenities Score:

Measurement: Participants reported on the availability of various household amenities, covering aspects like home ownership, building material, flooring, room count, sanitary facilities, drinking water access, lighting source, and ownership of appliances and vehicles.

Numerical Values: Responses were assigned numerical values, and scores were summed.

Scoring Range: Scores ranged from 11 to 33, signifying the level of household amenities.

Categorization: Participants were classified into three categories based on their scores: low level (less than 20 points), moderate level (20-28 points), and high level (more than 28 points).

Dependent variables:

The dependent variables in this study focus on measuring the social return of the project across

three dimensions: individual level, social welfare level (community improvements), and satisfaction with the local community. These are detailed as follows:

(1) Individual Level:

Income Adequacy for Project Workers:

Measurement: Participants were asked about the adequacy of their income after working in the silkworm project, using a five-point scale.

Scoring: Theoretical scores ranged from 3 to 15 points.

Categorization: Participants were classified into three categories: low level (less than 7 points), moderate level (7-11 points), and high level (more than 11 points).

(2) Level of Development for the Participant:

Measurement: Assessed using an eleven-point scale to measure the perceived degree of development.

Scoring: Theoretical scores ranged from 6 to 36 points.

Categorization: Participants were grouped into three categories: low level (less than 15 points), moderate level (15-25 points), and high level (26-36 points).

(3) Savings Level:

Measurement: Assessed using an eight-point scale to evaluate the extent of savings by the participants.

Scoring: Theoretical scores ranged from 6 to 20 points.

Categorization: Participants were categorized into three levels: low level (less than 12 points), moderate level (12-20 points), and high level (more than 20 points).

(4) Individual-Level Project Benefit:

Measurement: Participants were queried about the extent of their benefit from the project.

Numerical Values: Responses were assigned numerical values (3, 2, 1).

Scoring: The scores from the three previous dimensions were summed, resulting in a range from 24 to 72 points.

Categorization: Participants were classified into three categories based on the level of benefit: low level (24-40 points), moderate level (41-57 points), and high level (more than 57 points).

These individual-level metrics provide a comprehensive understanding of the impact of the silkworm project on participants' income, development, savings, and overall project benefit.

Social Welfare Level:

(1) Social Returns on Participants:

Measurement: This dimension assessed the social returns of the project on participants through 7 items, including self-help, self-confidence development, responsibility-bearing, positive values development, family conditions improvement, community participation, and a sense of community belonging.

Scoring: A scale composed of 21 phrases was used, with weighted scores (3, 2, 1) based on the level of achievement. Scores were summed, with theoretical scores ranging from 21 to 63 points.

Categorization: Participants were divided into three categories: low returns (21-35 points), moderate returns (36-50 points), and high returns (more than 50 points).

Table (6): Distribution of respondents according to their studied characteristics:

Variables	N=50	
	Number	%
Age		
Young (under 25 years old)	15	30.00
Medium (25-40 years old)	25	50.00
High (over 40 years)	10	20.00
Years of Education		
Low level (under 5 years)	13	26.00
M. level (5-15 years old)	28	56.00
High level (over 15 years old)	9	18.00
Family Size		
Small (less than 5 persons)	13	26.00
Medium (5-8 persons)	27	52.00
Large (more than 7 persons)	10	20.00
Agricultural Holdings Size		
Small (less than 5 acres)	29	58.00
Medium (5-10 acres)	13	26.00
Large (more than 9 acres)	8	16.00
Exposure to Communications Channels		
Low level (less than 9 grades)	12	24.00
M. level (9-14 grades)	25	50.00
High level (15-20 grades)	13	26.00
Openness to the outside world		
Low openness (less than 5 grades)	12	24.00
Medium openness (6-10 grades)	29	58.00
High openness (more than 10 degrees)	9	18.00
Reference Sources		
Low level (less than 5 grades)	8	16.00
M. level (6-13 grades)	12	24.00
High level (14-21 grades)	30	60.00
Participation in Organizations		
Low participation (less than 10 marks)	33	66.00
Medium participation (10-15 marks)	11	22.00
High participation (more than 15 marks)	6	12.00
Household Amenities Score		
Low level (less than 20 grades)	14	28.00
M. level (20-28 grades)	26	52.00
High level (more than 28 marks)	10	20.00

Source: Questionnaire form 2023.

(2) Improvements in the Community:

Measurement: This dimension assessed improvements in the community through five items, including reduction in unemployment, occupational transformation, social stability, environmental preservation, and alleviation of feed and routine crises.

Scoring: A scale consisting of 15 points was used, with weighted scores (3, 2, 1) based on the level of achievement. Scores were summed, with theoretical scores ranging from 3 to 15 points.

Categorization: Participants were divided into three categories: low returns (3-7 points), moderate returns (8-12 points), and high returns (more than 12 points).

(3) Satisfaction with the Local Community:

Measurement: This variable assessed participants' satisfaction with the local community using eight phrases covering positive and negative aspects.

Scoring: Responses were assigned weighted values (3, 2, 1) for positive responses and (1, 2, 3) for negative responses. The scores for negative

responses were summed, with theoretical scores ranging from 3 to 24 points.

Categorization: Participants were divided into three categories: low satisfaction level (3-10 points), moderate satisfaction level (11-18 points), and high satisfaction level (more than 18 points).

Description of Research Participants:

- 50% of participants are in the middle age category (25-40 years).
- 56% have a moderate level of education.
- 52% come from families with a medium family size.
- 58% have small agricultural holdings.
- Approximately 50% exhibit a moderate degree of exposure to communication means.
- 58% have a moderate level of openness to the outside world.
- 60% have a high level of reliance on reference sources.
- 66% have a low degree of participation in organizations.
- Around 52% have a medium level of household amenities.

This comprehensive overview provides insights into the characteristics and distributions within the research participant sample, enhancing the understanding of the study's context.

The results related to the social return on investment of the project:

Description of the level of benefit for the research participants at the individual level:

The table (7) provides an overview of the distribution of research participants according to their perceived level of benefit from the project. The findings reveal the following patterns: Approximately 20% of the participants fall into the category of having a low level of benefit from the project. The majority, constituting around 70% of the total participants, are situated in the average level of benefit. The high-level category is represented by nearly 10% of the participants. This distribution offers valuable insights into the varying degrees of impact and satisfaction among the research participants, shedding light on the effectiveness and success of the silkworm project from their perspective.

Table (7): Breakdown of respondents by their individual project benefit levels

Benefit level	Number	%
low (24-40 degrees)	10	**20**
Medium (41-57 degrees)	35	**70**
High (greater than 58 degrees)	6	**10**
Total	**50**	**100**

Source: Questionnaire form 2023.

The results presented in Table 8 indicate significant positive relationships, at the 0.01 probability level, between individual researchers' utilization level and the following studied variables: years of education, degree of exposure to communication media, and level of household facilities. The respective Pearson correlation coefficient values were 0.343, 0.264, and 0.637. These findings suggest that higher levels of education, increased exposure to communication media, and improved household facilities are associated with a higher utilization level of the project among individual researchers.

Furthermore, the multiple stepwise regression analysis revealed that only three variables out of the studied set had a significant positive impact, at

the 0.01 probability level, on individual researchers' utilization level. These three variables are specifically identified as years of education, degree of exposure to communication media, and level of household facilities.

The coefficient of determination (R^2) value of 0.933 implies that the collective influence of the nine independent variables explains approximately 93.3% of the variance in the utilization level of the researchers. Additionally, the model's regression relationship between the independent variables and the utilization level of the researchers at the individual level is statistically significant at the 0.01 probability level, as indicated by an F value of 40.77.

Therefore, based on the results of the multiple regression analysis, the first null hypothesis concerning the variables—years of education, degree of exposure to communication media, and level of household facilities—has been rejected. This suggests that these variables significantly contribute to explaining and predicting the utilization level of the project among individual researchers.

Table (8): Simple Correlation Coefficients and Partial Regression for the Relationship between Study Variables and Individual Project Utilization

Variables	Pearson Correlation	Partial Regression	T
Years of Education	0.343 ($p < 0.01$)	0.219	5.04**
Degree of Exposure to Media	0.264 ($p < 0.01$)	0.188	3.77**
Level of Household Facilities	0.637 ($p < 0.01$)	0.465	6.35**

Source: Questionnaire form 2024.

Description of the Participants' Social Welfare Level:

The table (9) provides an overview of the distribution of participants based on their social welfare level. The findings are summarized as follows:

- Approximately 22% of the participants fall into the category of having a low level of social welfare.
- The majority, comprising around 62% of the total participants, are situated in the average level of social welfare.
- The high-level category is represented by nearly 16% of the participants.

This distribution sheds light on the varying degrees of social welfare among the participants, highlighting the distribution of resources, opportunities, and support systems within the studied population. It indicates the prevalence of different levels of social welfare and underscores the importance of addressing disparities and promoting well-being across diverse segments of society.

Table (9): Distribution of Participants according to Social Welfare Level.

Social Welfare Level	Number	%
low (36-60 degrees)	11	22.00
Medium (61-85 degrees)	31	62.00
High (greater than 85 degrees)	8	16.00
Total	50	100.0

Source: Questionnaire form 2023.

The relationship between the social welfare level of the participants and the studied variables:

The Pearson correlation coefficient results, as shown in Table 10, demonstrate a statistically significant positive correlation at the 0.01 level between participants' social welfare status and the following variables: years of education, reference sources used organizational participation, and household amenities. The respective correlation coefficients were 0.632, 0.470, 0.787, and 0.644. Additionally, multiple stepwise regression analysis presented in Table 10 reveals that out of all variables studied, only four had a significant positive impact at the 0.01 level on participants' social welfare status. These four decisive variables are: education years, reference sources, organizational participation, and household facilities. No significant effects were detected for other variables.

Table (10): Simple Correlation Coefficients and Partial Regression for the Relationship between Studied Variables and Social Welfare.

Variable	Pearson Correlation	Partial Regression	T
Years of Education	0.632 ($p < 0.01$)	0.464	6.55**
Reference Sources	0.470 ($p < 0.01$)	0.322	5.22**
Participation in Orgs.	0.787 ($p < 0.01$)	0.562	5.70**
Household Facilities	0.644 ($p < 0.01$)	0.452	6.08**

Source: Questionnaire form 2023.

Given the coefficient of determination (R^2) value of 0.832, the studied independent variables collectively account for approximately 83.2% of the variation in participants' social welfare levels. Also, the regression relationship in the model between independent variables and participants' welfare levels is statistically significant at the 0.01 level, with an F-value of 44.67.

Satisfaction with the Local Community:

As shown in Table 11, about 28% of participants reported low satisfaction with their local community. An average satisfaction level was indicated by around 56% of participants, while roughly 16% expressed high satisfaction with their local community.

Table (11): Distribution of Participants According to the Level of Satisfaction with the Local Community.

Satisfaction Level	No	%
Low Satisfaction (3-10 points)	14	28.00
M. Satisfaction (11-18 points)	28	56.00
H. Satisfaction (More than 18 points)	8	16.00
Total	50	100.0

Source: Questionnaire form 2023.

The results of Pearson's correlation coefficient: As shown in Table 12, there was a statistically significant positive correlation at the 0.01 level between respondent characteristics and the studied variables of age, education, and reference sources used, and household facilities level. The respective correlation coefficients were 0.820, 0.551, 0.892, and 0.773. Additionally, multiple

stepwise regression analysis presented in Table 12 demonstrates that only four of the studied variables had a significant positive effect at the 0.01 probability level on respondent satisfaction with their local community.

With a coefficient of determination (R2) of 0.776, the five independent variables collectively account for approximately 77.6% of the variation in respondent local community satisfaction. The calculated F-value of 37.40 indicates that at the 0.01 probability level, the model statistically significantly explains the relationship between the independent variables (age, years of education, reference sources, and household facilities level) and local community satisfaction. Thus, the null hypothesis can be rejected for these four variables, while it fails to be rejected for the other studied independent variables.

Table (12): Simple Correlation and Partial Regression Coefficients for Respondents' Distribution According to Local Community Satisfaction Level.

Variable	Pearson Correlation	Partial Regression	T
Age	0.820 ($p < 0.01$)	0.466	4.62**
Years of Education	0.551 ($p < 0.01$)	0.343	6.33**
Reference Sources	0.892 ($p < 0.01$)	0.446	5.32**
Household Facilities	0.773 ($p < 0.01$)	0.457	4.22**

Source: Questionnaire form 2023.

The problems faced by silk producers in the production process:

The results in Table (13) concerning the problems faced by the beneficiaries of the silk production project from silkworms showed that the most significant problem is marketing and distribution, with a relative importance of approximately 20% of the total problems. In the second place, there is a problem with the lack of training in modern breeding methods, accounting for about 17.78%.

Table (13): Problems of the Silk Production Project from Silkworms in Egypt

No	Problems	Frequencies	%	Rank
1	Shortage of Mulberry Leaves	22	9.78	7
2	Decrease in Price per Kilogram of Silk Cocoons	28	12.44	5
3	Unavailability of Modern Equipment	35	15.56	3
4	Diseases and Pests Affecting Silkworms	25	11.11	6
5	Shortage of Trained Labor	30	13.33	4
6	Marketing and Distribution	45	20.00	1
7	Lack of Training in Modern Methods	40	17.78	2
Total		**225**	**100**	-

Source: Questionnaire form 2023.

Following that, in the third place, there is the issue of the unavailability of all modern breeding tools, with a percentage of approximately 15.56%. In the fourth place, there is a relative importance of about 13.33% for the problem of a shortage of trained labor. In the fifth place, there is a problem with the declining price per kilogram of silk cocoons, accounting for approximately 12.44%. In the sixth place, there is the problem of diseases and pests affecting silkworms, with a relative

importance of about 11.11% of the total problems. Finally, in the seventh and last place, there is the issue of a shortage of mulberry leaves, with a relative importance of about 9.78% of the total problems facing the producers.

RECOMMENDATIONS:

(1) Market Expansion: Explore new domestic and international markets for silk products to decrease reliance on a single market and enhance profitability.

(2) Quality Assurance: Enforce stringent quality control protocols to maintain consistent high standards in silk production, fostering increased market demand and improved pricing.

(3) Financial Accessibility: Simplify access to financing avenues like microloans or grants for project participants, facilitating investments in equipment, infrastructure, and raw materials.

(4) Sustainable Practices: Advocate for sustainable and eco-friendly approaches in silk production to ensure its long-term viability and meet consumer preferences for environmentally conscious products.

(5) Collaborative Partnerships: Foster collaborations with research institutions, universities, and industry specialists to stay abreast of cutting-edge silk production techniques and pest management strategies.

(6) Community Involvement: Cultivate a sense of community and knowledge exchange among project participants through workshops, training, and peer-to-peer learning initiatives.

(7) Performance Monitoring: Establish a robust system for monitoring and evaluating project performance regularly, identifying obstacles and adjusting strategies accordingly.

(8) Government Advocacy: Lobby for government backing and policies conducive to the silk industry's growth, such as subsidies, tax breaks, and infrastructure enhancement.

(9) Gender Equality: Ensure gender inclusivity by actively engaging women in decision-making processes and providing equal opportunities for men and women within the project.

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